Bibliotheca Herpetologica

A Journal of the History and Bibliography of Herpetology

Vol. 17

International Society for the History and Bibliography of Herpetology

The Society

Mission. The ISHBH aims to promote research related to historical herpetology. The Society is devoted to stimulating and advancing the study of the history of the herpetological discipline and its bibliography. We bring together individuals for whom the history and bibliography of herpetology are appealing. We promote the knowledge of these and related topics among members and the general public. The Society was established in 1998. Membership is open to anyone who shares the aims of the Society.

Activities. The society members meet every year, usually in connection with other general herpetological meetings with international participation. Activities include visits to private and public libraries, museums and other places with historical links to the discipline. We organize workshops and sessions in the fields that form parts of larger national or international meetings on herpetology. Our shared lunches adjacent to the yearly business meetings have become popular among members and guests. The Society works to facilitate both formal and informal contacts among members.

Journal. The ISHBH publishes the journal *Bibliotheca Herpetologica*, which is the central pillar of the Society. It contains articles, essays, bibliographies and news of people and events in our field and is a peer-reviewed. The many important contributions make the publication a vital source for bibliographers, historians and taxonomists alike but at the same time the papers are by and large appealing to the layperson in the field.

Beginning with volume 14, ISHBH will adopt an open access publication model. Articles in Bibliotheca Herpetologica will be available online as soon as they receive final editorial approval. At the end of the year a hard copy version of Bibliotheca Herpetologica, containing all articles published that year, will be printed and distributed to current members.

The name of the journal, up to volume 5(1), was: *International Society for the History and Bibliography of Herpetology Newsletter and Bulletin*.

Membership. The membership fees cover the calender year. ISHBH membership categories are: Corresponding Membership US$25/year (open access only plus all other membership benefits), Regular Membership US$50/year, Institutional Memberships US$75/year, and Sponsoring US$75/year. Note that Life Members will retain their status. However, we are no longer offering new Life Memberships. To Join, go to our website http://www.ishbh.com and click on the Membership tab.

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From the Chairman

After four years of the "re-constituted" ISHBH I think we can say that our Society has demonstrated a track record of producing quality publications in open access format. Like many of you, I read each article online as it becomes available, but I still look forward to receiving the hard copy at the end of the year. As Breck Bartholomew notes in his Editor's Message, we still have room for growth in terms of author diversity and the reviewer pool. Nonetheless, the Society's publications are thriving. I would like to take this opportunity to remind members (and prospective members) that the ISHBH is more than just its publications. Each year we hold an in-person business meeting to present a summary of the Society's activities and its finances. It is, however, also an opportunity to meet and network with others with an interest in herpetological history. This year we met in conjunction with the Joint Meeting of Ichthyologists and Herpetologists (JMIH) in Norfolk, Virginia, USA. Twenty-one people attended the business meeting, an ISHBH record! Many attendees were not members but came to find out about the Society. Several attendees saw our publications for the first time and some who liked what they saw have subsequently joined.

In August 2024, the ISHBH will be a participating society at the 10th World Congress of Herpetology in Kuching, Sarawak in the Malaysian part of Borneo. This will be an amazing opportunity to meet with like-minded "herp-historians" from around the world and there will be a Herpetological History symposium at the Congress as well. The symposium, organized by Chris Bell, already has a diverse slate of speakers, but if you plan to attend and have something of historical or bibliographic relevance to present, your contribution can still be included in the program. But, as meeting costs can be high and not everyone has the time or inclination travel to distant conferences, I encourage everyone to try to engage with the ISHBH and fellow members through other means, like the ISHBH Facebook group (www.facebook.com/groups/ishbh/). I also invite you to contact Society officers, who can be reached via links on the website (www.ishbh.com), with your ideas and suggestions for making the ISHBH a more interactive and dynamic organization. Or better yet, consider becoming an officer yourself or contributing as an author, reviewer, or symposium speaker and, of course, recommend the Society to your friends and colleagues!

Aaron M. Bauer, Chairman
Villanova, Pennsylvania, USA

From the Editor

This volume represents the fourth volume completed in our open access format. The 12 papers and one update are authored by 17 different individuals from eight different countries (Argentina, 1; Austria, 1; Brazil, 2; Canada, 1; Germany, 3; Switzerland, 1; United States of America, 5; and Venezuela , 3). One author, C. Kenneth Dodd, appeared on two contributions and the update; all other authors appeared on one contribution each. This is an admirable diversity for such a small journal. We are, however, lacking in many areas. If we combine the last four volumes, we only add one female author and four additional countries (Australia, Portugal, Russia, and Sweden). We have not had a single author in the last four years from the entire continents of Africa or Asia, the subcontinent India, or the Middle East, yet all of these areas have a rich herpetological history. This year saw the publication of the book, *Women in Herpetology: 50 Stories from Around the World*, but women are conspicuously absent from *Bibliotheca Herpetologica*. We have made, and continue to make, strides in increasing our diversity and thus our coverage of herpetological history, but we have a long way yet to go.

Another area that continues to be a struggle for *Bibliotheca Herpetologica* is finding reviewers. This is not unique to ISHBH and there have been many articles and editorials about peer review in recent years. In one of these editorials, Troping, et al. (2023) summarized the issue: "At a basic level, scientific reviewing should provide some kind of gratification to the reviewer, whether intellectual (staying at the forefront of the field), social (networking), cultural (status from being a respected reviewer), or monetary. Unfortunately, the current incentives to review are clearly not enough. Without any kind of credit, it becomes hard to justify spending time and energy reviewing when researchers are already overwhelmed. We posit that this exhaustion and frustration have led to a global decrease in the sense of belonging to a scientific community that requires altruism to function."

With the exception of monetary compensation, reviewing papers for ISHBH seems to fit this summary. There are social, cultural, and intellectual reasons to review papers for ISHBH, but as with any review, recognition may be limited to an acknowledgment. I would argue that the joy of delving into a historical topic, which often times may be quite unknown to anyone other than the author, is immensely satisfying. If you have any interest in reviewing a paper for ISHBH, please let me know.

That brings me to one other topic, 2024 is an election year for ISHBH. I know some of the Board members feel the society could benefit from new perspectives and ideas. Although stability has its place, change is necessary for a society to grow and recruit young members. The current Board has been in place for four years or more and it is time to add some fresh ideas and perspectives. Please keep this in mind and consider running for a Board position later this year.

Enough with the needs of ISHBH. I don't want to give the impression that we are struggling or failing in any way. ISHBH is becoming more dynamic every year—just look at the number and diversity of authors in this volume. One particularly satisfying event for me this year grew out of ISHBH. Through meeting and interacting with Hans Jacobs last year after he submitted the first of two papers on the Natuurkundige Commissie's expedition to New Guinea in 1828 (Jacobs and Shea 2022), Hans was able to track down the unusual history of a volume in my personal collection (Jacobs 2023). As it turned out the volume had been stolen from Lübeck Library in the aftermath of World War II. On May 8, 2023, Hans Jacobs and I met in Lübeck, Germany, where Hans arranged a meeting with the director of Lübeck Library, Angela Buske, to return the book to its rightful home nearly 80 years after it was stolen (Presseamt Lübeck 2023; Fig 1).

While in Lübeck we were given a tour of the rare book collection and were able to examine the other 18 volumes in the Heinrich Rost collection that have been returned, so far. Approximately fifty volumes are still missing. The article by Hans, in this volume, about the Rost collection will serve as a published record of the collection, its history, and the volumes that remain unaccounted for. It is hoped that through the efforts of Hans and the ISHBH, more of the missing volumes will be returned to Lübeck Library.

As we look ahead to 2024, we have at least one submission for *Wahlgreniana* that is expected to be published in 2024, and a couple more volumes in the preliminary stages. *Bibliotheca Herpetologica* already has one paper ready to be published and two more in the review process. Authors have indicated that additional papers will be submitted soon. All indications are that volume 18 will continue to build on our progress over the last four years. It is quite an achievement for such a small society, with an open access publication model and no author charges whatsoever, to have maintained our quality output for four years with no end in sight. In addition, hardcopies of each of these volumes have been produced on time. In my experience this is unique among small societies and it is a credit to everyone involved in ISHBH, including our dues paying members who value the society enough to make sure we can continue to publish with our no cost, open access model.

Breck Bartholomew, Editor
Salt Lake City, Utah, USA

Fig. 1. Hans Jacobs, Angela Buske, and Breck Bartholomew returning a book by Heinrich Rost to the Lübeck Library. The book had been missing since World War II when it was among items looted by Allied Forces (see Jacobs 2023 for more details).

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About The Cover

The image on the cover comes from Mark Catesby's (1683–1749) 1747 two-volume work, *The Natural History of Carolina, Florida and the Bahama Islands*. This is considered the first published illustrated guide to a North American flora and fauna. In it, Catesby illustrated, in color, over 400 plant and animal taxa including nineteen snakes. The cover image, plate 42 from Catesby's work, depicts what he called "The Small Rattle-Snake", *Vipera caudisona Americana minor*, and is currently believed to be an illustration of *Sistrurus miliarius*.

Each of Catesby's two volumes contained one hundred plates, issued in twenty plate fascicles as each fascicle was completed from 1729 to 1743, with the snakes having been presented in 1737. Later English language editions have been published, beginning in 1754 by naturalist George Edwards. Bookseller Benjamin White added a third in 1771, and it is from this edition the cover image comes from. The specific image can be found online at https://dc.lib.unc.edu/cdm/compoundobject/collection/dmisc/id/1911/show/1747 hosted by the University of North Carolina at Chapel Hill Wilson Library (copyright public domain). For more information on the snakes depicted in Catesby's *The Natural History of Carolina, Florida and the Bahama Islands* see the article by Bob McKeever, "Mark Catesby's Snakes of Carolina: A Review", on p. 10.

International Society for the History and Bibliography of Herpetology
Bibliotheca Herpetologica

Snakes in a Grave—or Not

C. Kenneth Dodd, Jr.

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Chester Bedell (1836–1908; Fig. 1) was a successful farmer and well-known citizen of the Deerfield-North Benton region of northeastern Ohio. He was intensely interested in religion and a Biblical scholar, not as a practicing Christian, but as an atheist bent on disproving the existence of God and substituting rational thought for what he viewed as Christian dogmatic mythology. He was quite vocal about his beliefs in the community, even hosting public discussions with preachers and others where he cogently espoused his views. Naturally this was not popular among local believers, particularly the Presbyterian Church of North Benton, leading to intense opposition and outright hatred among the fundamentalist faithful. Bedell authored a book on his beliefs and battles with the local Presbyterian clergy (Bedell 1897; Figs. 2, 3), which further ostracized him as a heretic in the community. An Alliance (Ohio) eulogy noted in 1908, however, that he was a good man devoted to his family and community[1]. According to the caption under a photo of Bedell's monument in a publication of the Berlin Center Historical Society (2000, p. 126), "Mr. Bedell's home was always open to visiting ministers or hoboes for a meal, lively discussion, or night's stay. He donated the church bell to the Berlin Methodist Church."

Prior to his death, Bedell posed for a statue of himself to be erected on top of a 10-foot pedestal on his grave. The statue was in bronze and cast by the Mullins Company in Salem, Ohio, and depicts him holding a scroll in the air stating "Universal Mental Liberty" while standing on a scroll inscribed "Superstition." Naturally, this did not endear him further to the Christian religious community, and through the years, the statue and grave were frequently vandalized. Eventually the statue was removed (with 19 bullet holes in it) for safekeeping and in 1993 was donated to the Berlin Center (Ohio) Historical Society where it is now located in the Weidenmier House (Berlin Center Historical Society 2000). But that is only part of the story surrounding Bedell's grave.

At some point, a story was circulated that Bedell had stated "If there is a God, may snakes infest my grave." No one seems to know where the story originated. It is doubtful that Bedell actually made this exact claim, but it seemed to suit the purpose of his enemies and may have been consistent with Bedell's character. Legend had it that hundreds of snakes could be observed on his grave at its original location

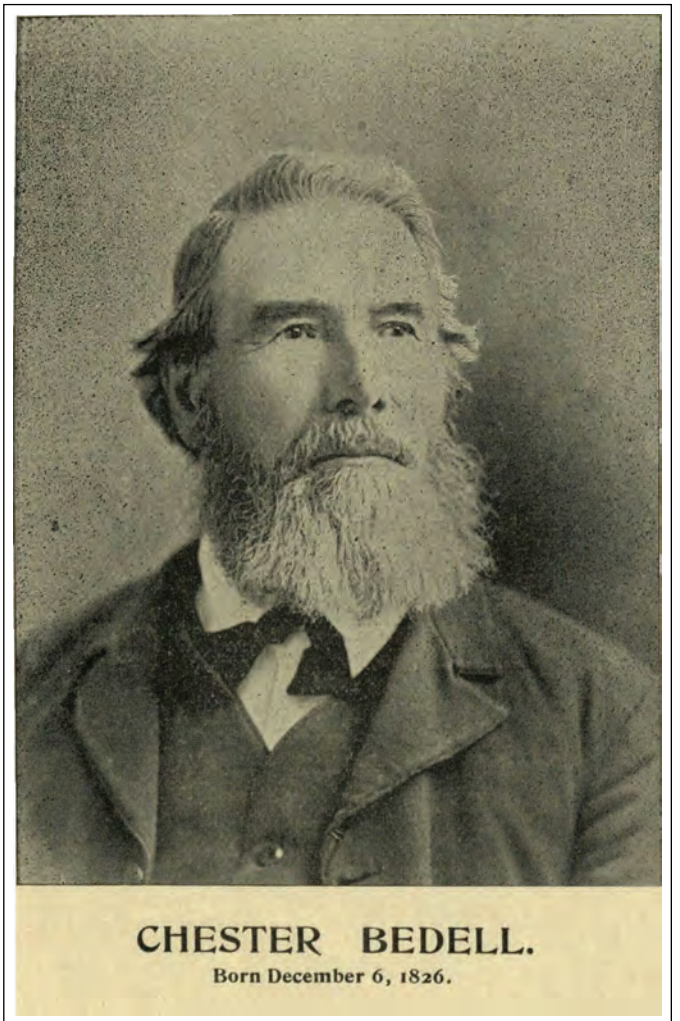

Fig. 1. Chester Bedell. From his book *Twenty-one Battles*, 1897. Courtesy of the Ohio History Connection, Columbus, Ohio.

in Hartzell Cemetery. According to some accounts, hundreds of visitors might show up in a day to observe the anticipated spectacle well into the late 1930s. It is alleged that local boys or others actually salted the gravesite with garter and blacksnakes, and that a nearby restaurant owner paid them to do so to drum-up business.

The legend was advanced among evangelicals through the publication and wide distribution in the 1930s of several

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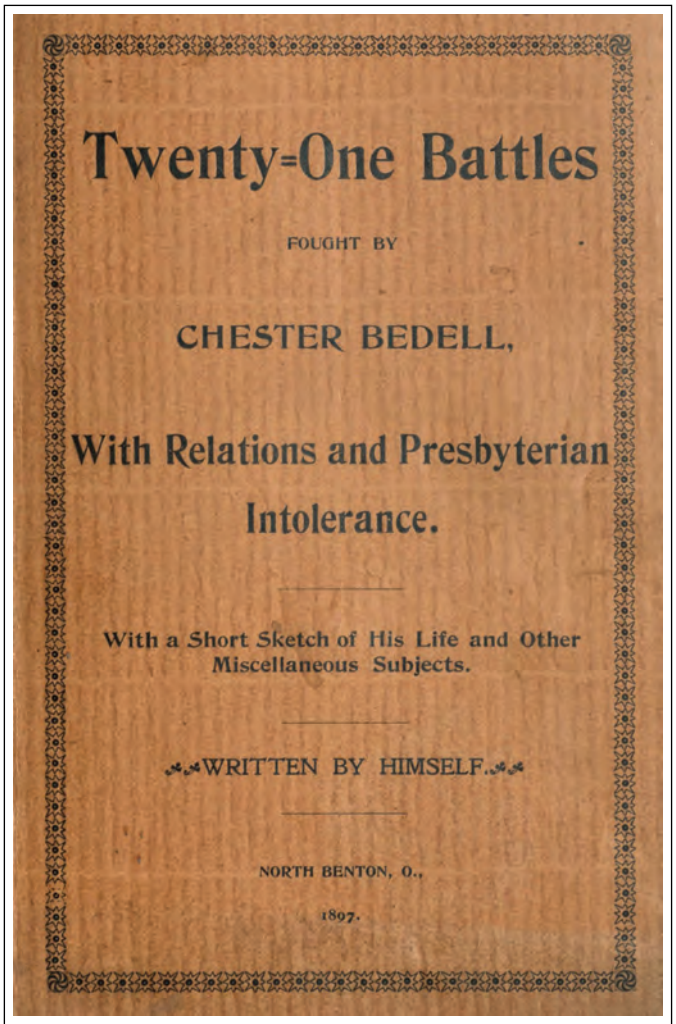


Fig. 2. Cover of *Twenty-one Battles*, 1897. Courtesy of the Ohio History Connection, Columbus, Ohio.

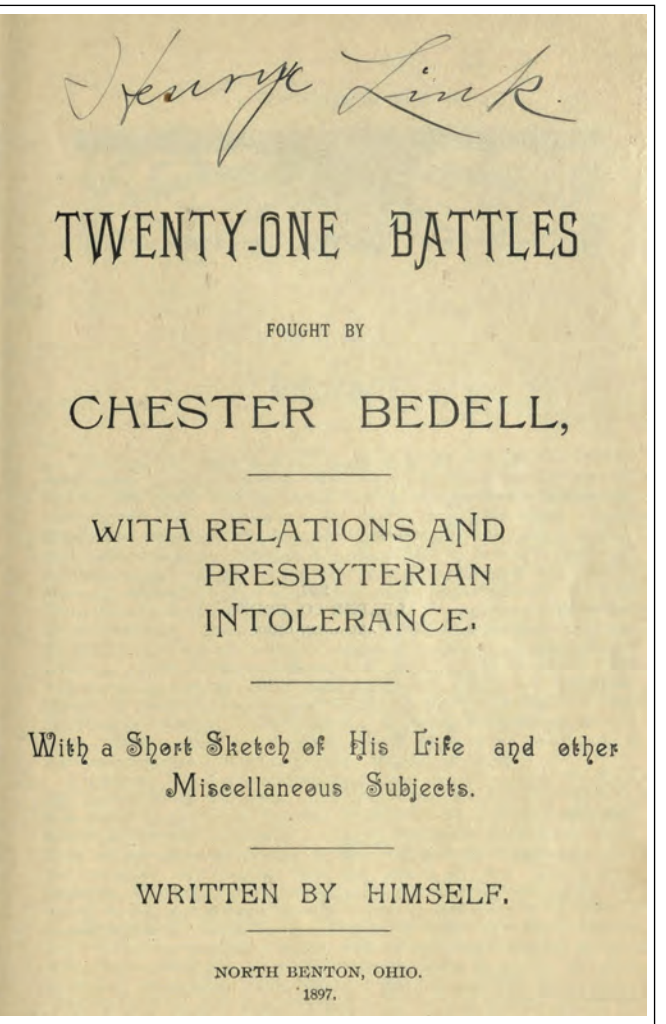
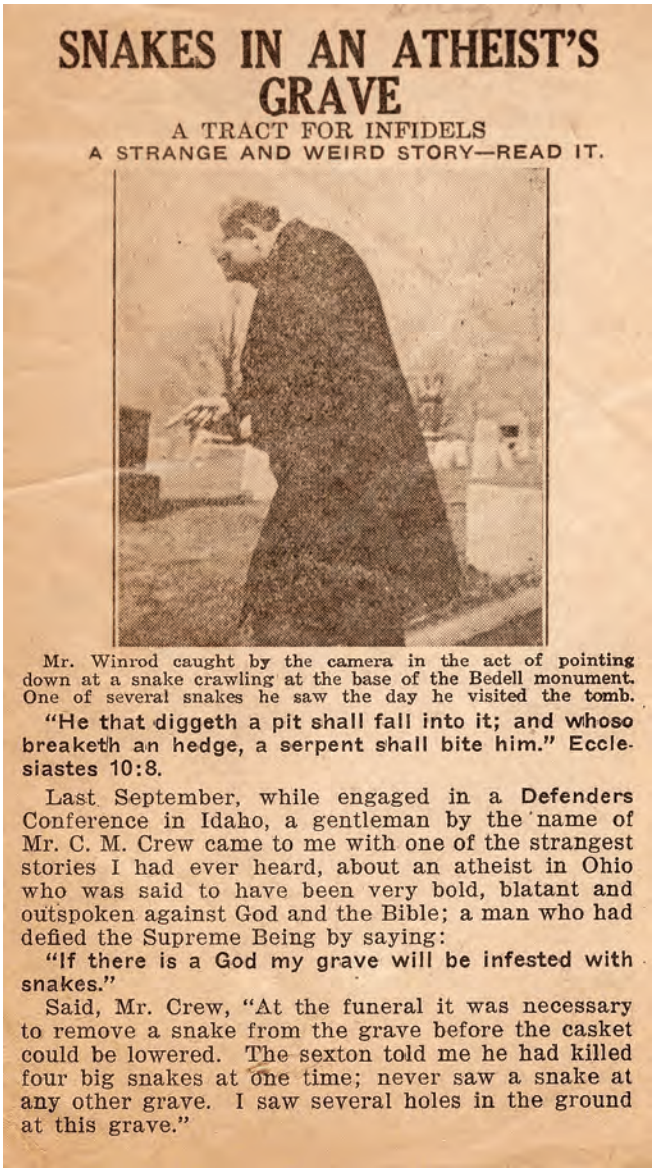


Fig. 3. Title page of *Twenty-one Battles*, 1897. Courtesy of the Ohio History Connection, Columbus, Ohio.

booklets by preachers and others claiming to have witnessed the grave covered with snakes, and therefore proof of God's existence. Copperheads (*Agkistrodon contortrix*) were among those mentioned as swarming from the grave, although this species does not occur in the area. The legend achieved additional publicity from a story published by Ernie Pyle, the famous WWII correspondent, in the American Weekly in 1938[2] (Nichols 1989). Pyle sided with those debunking the claim ("There are no snake holes in Chester Bedell's grave. I'll bet there isn't one snake in five years that crawls right over the grave"). Despite the "testimonies" contained in evangelical publications, there is no proof anyone ever saw snakes exiting from or on Bedell's grave, aside perhaps from those let loose on it by locals seeking to increase visitors for commercial reasons or to generate publicity. Photos of individuals holding snakes on the grave also could have been staged, and do not prove the snakes were actually killed at the grave. In 1943, Bedell's grave was moved to a new location to make way for the construction of Berlin Lake, and snakes have never been observed at its relocated site.

I have copies of an undated tract and two of the evangelical booklets that appeared in the early 1930s concerning this legend. The tract, originally published in *The Defender*, a publication of the Defenders of the Christian Faith, a fundamentalist Christian organization with fascist sympathies, featured American evangelist Gerald Burton Winrod's (1900–1957) visit to Bedell's grave and was published by the Free Tract Society of Los Angeles, California[3]. It is small (17 cm unfolded x 15 cm high) and very fragile. Winrod was virulently anti-Jewish, supported segregation, opposed teaching evolution, and was later charged with sedition for his support of Nazi Germany (charges later dropped). The small pamphlet is perhaps the most hyperbolic rendition of the legend of snakes in an atheist's grave, complete with first person accounts of serpents infesting the grave and mention of large numbers of snakes killed there. The tract includes photos of Winrod allegedly pointing at a snake, Bedell's monument, and the North Benton Presbyterian Church (Fig. 4 a–d). Curiously, there are no photos of snakes, although the tract states that photos were taken of the many snakes observed.



SNAKES IN AN ATHEIST'S GRAVE

A TRACT FOR INFIDELS

A STRANGE AND WEIRD STORY—READ IT.

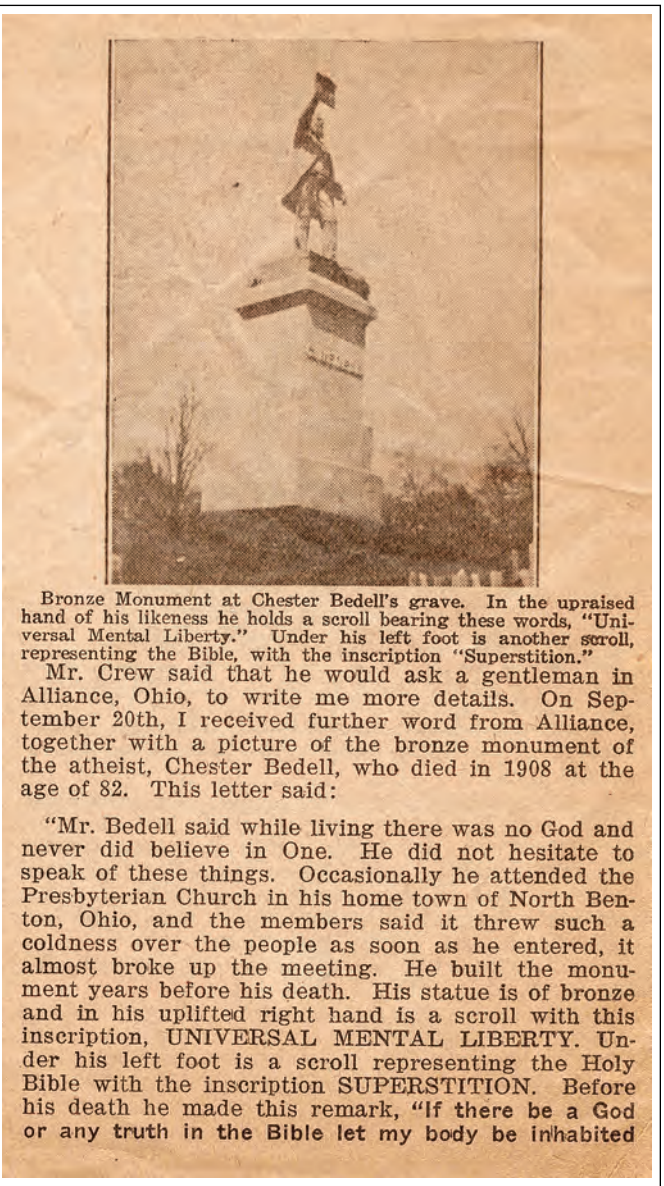
Mr. Winrod caught by the camera in the act of pointing down at a snake crawling at the base of the Bedell monument. One of several snakes he saw the day he visited the tomb.

"He that diggeth a pit shall fall into it; and whoso breaketh an hedge, a serpent shall bite him." Ecclesiastes 10:8.

Last September, while engaged in a Defenders Conference in Idaho, a gentleman by the name of Mr. C. M. Crew came to me with one of the strangest stories I had ever heard, about an atheist in Ohio who was said to have been very bold, blatant and outspoken against God and the Bible; a man who had defied the Supreme Being by saying:

"If there is a God my grave will be infested with snakes."

Said, Mr. Crew, "At the funeral it was necessary to remove a snake from the grave before the casket could be lowered. The sexton told me he had killed four big snakes at one time; never saw a snake at any other grave. I saw several holes in the ground at this grave."



Bronze Monument at Chester Bedell's grave. In the upraised hand of his likeness he holds a scroll bearing these words, "Universal Mental Liberty." Under his left foot is another scroll, representing the Bible, with the inscription "Superstition."

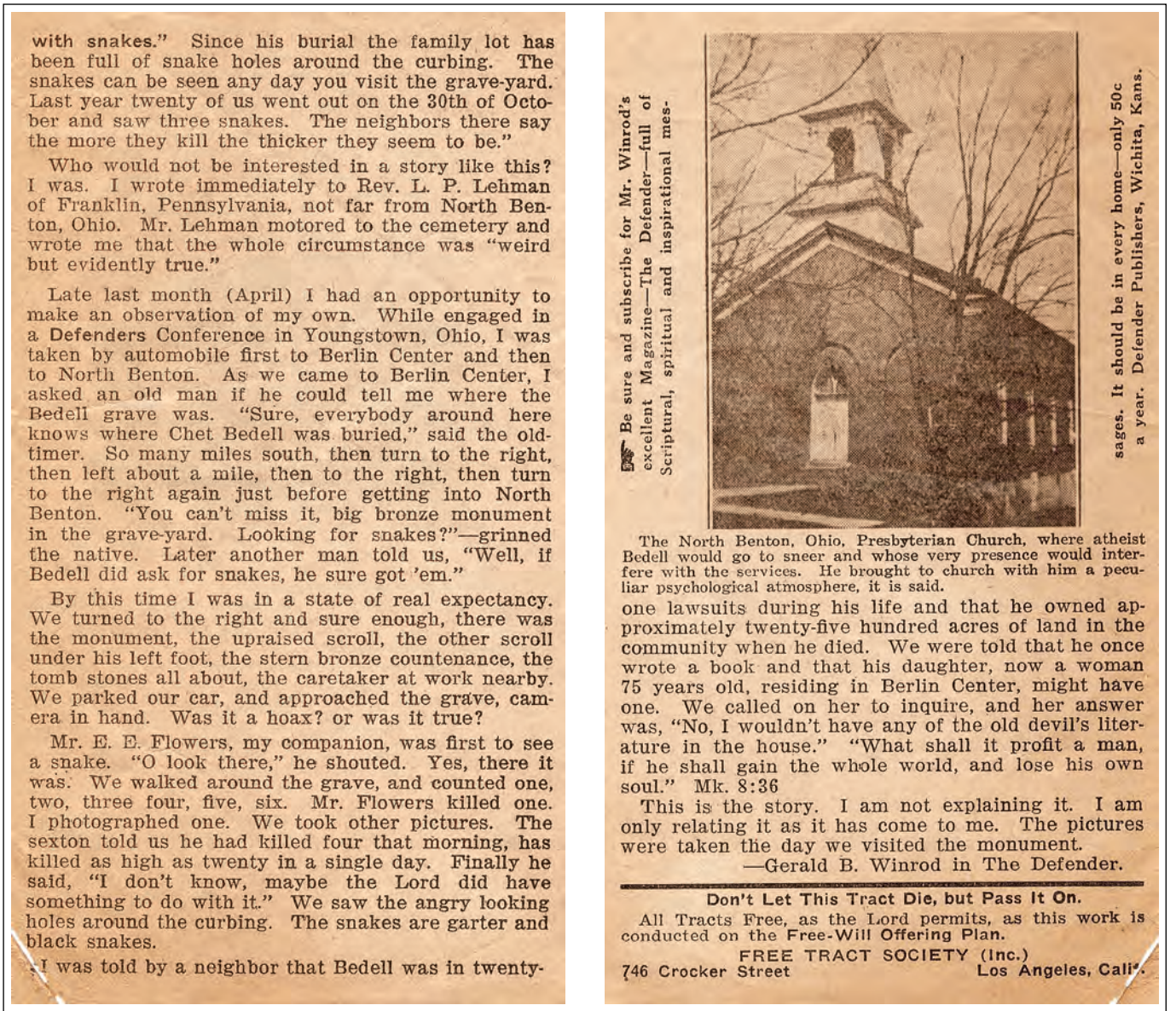
Mr. Crew said that he would ask a gentleman in Alliance, Ohio, to write me more details. On September 20th, I received further word from Alliance, together with a picture of the bronze monument of the atheist, Chester Bedell, who died in 1908 at the age of 82. This letter said:

"Mr. Bedell said while living there was no God and never did believe in One. He did not hesitate to speak of these things. Occasionally he attended the Presbyterian Church in his home town of North Benton, Ohio, and the members said it threw such a coldness over the people as soon as he entered, it almost broke up the meeting. He built the monument years before his death. His statue is of bronze and in his uplifted right hand is a scroll with this inscription, UNIVERSAL MENTAL LIBERTY. Under his left foot is a scroll representing the Holy Bible with the inscription SUPERSTITION. Before his death he made this remark, **"If there be a God or any truth in the Bible let my body be inhabited**

Fig. 4. a. – b. *Snakes in an atheist's grave*. Undated religious tract. Free Tract Society, Los Angeles.

The first booklet (Figs. 5, 6), by Charles Brougher Jernigan (1863–1930) and published the year Jernigan died, briefly reviews the legend complete with a black-and-white photo of snakes hanging from a stick propped on the pedestal of Bedell's grave (Fig. 7). The photo was taken by the Reverend Raymond Dobie who, with another man, had reportedly killed the snakes on the grave in November 1923. Jernigan was a rather prominent "hell fire and brimstone" Nazarene holiness preacher known for his incendiary sermons against all forms of sin, from kissing between unmarried persons to the immorality of dancing, cinema, playing with toy guns, alcohol, "harlotry," and gambling, as well as the theological errors of other churches. Much of the booklet is devoted to Biblical quotation and tirades against anything Jernigan found immoral in America. For example, several paragraphs were devoted to what has been termed "replacement theory," whereby Jernigan warned that "full blooded Americans" (by which he meant white native-born Christians) were quickly being outbred and replaced by Jews, Negroes, and Italian immigrants. On his visit to Bedell's grave, Jernigan reported seeing a dead snake on the grave on a cold winter's day, and that the ground was "full of snake holes."

A second more extensive booklet was published by William M. Smith (1872–1964), founder and superintendent of Union Bible Seminary of Westfield, Indiana, in 1933[4] (Figs. 8, 9, 10). As above, the book reiterates the legend of "snakes in an infidel's grave," but also includes an account of conversations Smith had with Bedell in the summer of 1906. Smith and Bedell carried on an apparently well-attended two-hour public discussion in a church meeting tent, prior to which Bedell had provided Smith a copy of his book. Smith's narrative not surprisingly suggests Bedell's many errors and the



with snakes." Since his burial the family lot has been full of snake holes around the curbing. The snakes can be seen any day you visit the grave-yard. Last year twenty of us went out on the 30th of October and saw three snakes. The neighbors there say the more they kill the thicker they seem to be."

Who would not be interested in a story like this? I was. I wrote immediately to Rev. L. P. Lehman of Franklin, Pennsylvania, not far from North Benton, Ohio. Mr. Lehman motored to the cemetery and wrote me that the whole circumstance was "weird but evidently true."

Late last month (April) I had an opportunity to make an observation of my own. While engaged in a Defenders Conference in Youngstown, Ohio, I was taken by automobile first to Berlin Center and then to North Benton. As we came to Berlin Center, I asked an old man if he could tell me where the Bedell grave was. "Sure, everybody around here knows where Chet Bedell was buried," said the old-timer. So many miles south, then turn to the right, then left about a mile, then to the right, then turn to the right again just before getting into North Benton. "You can't miss it, big bronze monument in the grave-yard. Looking for snakes?"—grinned the native. Later another man told us, "Well, if Bedell did ask for snakes, he sure got 'em."

By this time I was in a state of real expectancy. We turned to the right and sure enough, there was the monument, the upraised scroll, the other scroll under his left foot, the stern bronze countenance, the tomb stones all about, the caretaker at work nearby. We parked our car, and approached the grave, camera in hand. Was it a hoax? or was it true?

Mr. E. E. Flowers, my companion, was first to see a snake. "O look there," he shouted. Yes, there it was. We walked around the grave, and counted one, two, three four, five, six. Mr. Flowers killed one. I photographed one. We took other pictures. The sexton told us he had killed four that morning, has killed as high as twenty in a single day. Finally he said, "I don't know, maybe the Lord did have something to do with it." We saw the angry looking holes around the curbing. The snakes are garter and black snakes.

I was told by a neighbor that Bedell was in twenty-

Be sure and subscribe for Mr. Winrod's excellent Magazine—The Defender—full of Scriptural, spiritual and inspirational messages. It should be in every home—only 50c a year. Defender Publishers, Wichita, Kans.

The North Benton, Ohio, Presbyterian Church, where atheist Bedell would go to sneer and whose very presence would interfere with the services. He brought to church with him a peculiar psychological atmosphere, it is said.

one lawsuits during his life and that he owned approximately twenty-five hundred acres of land in the community when he died. We were told that he once wrote a book and that his daughter, now a woman 75 years old, residing in Berlin Center, might have one. We called on her to inquire, and her answer was, "No, I wouldn't have any of the old devil's literature in the house." "What shall it profit a man, if he shall gain the whole world, and lose his own soul." Mk. 8:36

This is the story. I am not explaining it. I am only relating it as it has come to me. The pictures were taken the day we visited the monument.

—Gerald B. Winrod in The Defender.

Don't Let This Tract Die, but Pass It On.

All Tracts Free, as the Lord permits, as this work is conducted on the Free-Will Offering Plan.

FREE TRACT SOCIETY (Inc.)

746 Crocker Street Los Angeles, Calif.

Fig. 4. c. – d. *Snakes in an atheist's grave*. Undated religious tract. Free Tract Society, Los Angeles.

righteousness of Smith's refutations, and how he was able to disprove Bedell's beliefs, usually by referring to his Bible. The booklet ends with two testimonials concerning the observation of snakes on the grave, including the Dobie photo mentioned above and one from the Reverend A.S. Joppie taken of a single snake allegedly killed in June 1944.

Of the six snakes in the two booklet photos, five are long and thin, with the remaining snake more substantial in body size. The photos are gray, poor, and grainy making an accurate identification impossible, but the location adjacent to a river in northeastern Ohio suggests that the slender snakes might be *Coluber constrictor* and/or *Thamnophis* sp., with the larger snake possibly *Pantherophis spiloides* (see Davis et al. 2021). All are quite harmless.

Subsequent reviews of the legend of "snakes in an atheist's grave" suggest little credence for Chester Bedell's gravesite ever being infested with, much less his grave being inhabited by, snakes. According to Ernie Pyle in 1938[2] and an account published in 2008[5(c)], no local person ever saw the snakes mentioned in the religious tracts, although a number of locals frequently "salted" the grave with dead snakes to stoke the legend, or told visitors stories they expected to hear. If snakes ever visited Chester Bedell's grave, they were likely looking for a thermally favorable basking spot in its near-river setting. Herpetologists in the past and today would no doubt welcome them.

Acknowledgements

I thank Melissa Dorsten, Library Services, Ohio History Connection, Columbus, Ohio, for providing the images of Chester Bedell and his book. Christopher Bell, John Simmons, and Gregory Watkins-Colwell provided helpful comments on

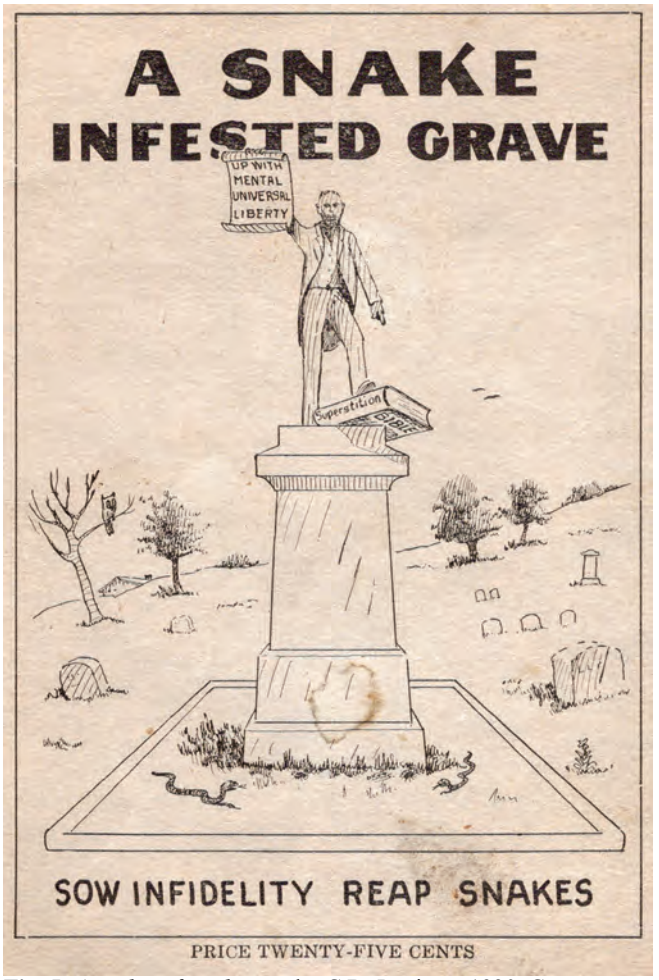


Fig. 5. *A snake infested grave* by C.B. Jernigan. 1930. Cover.

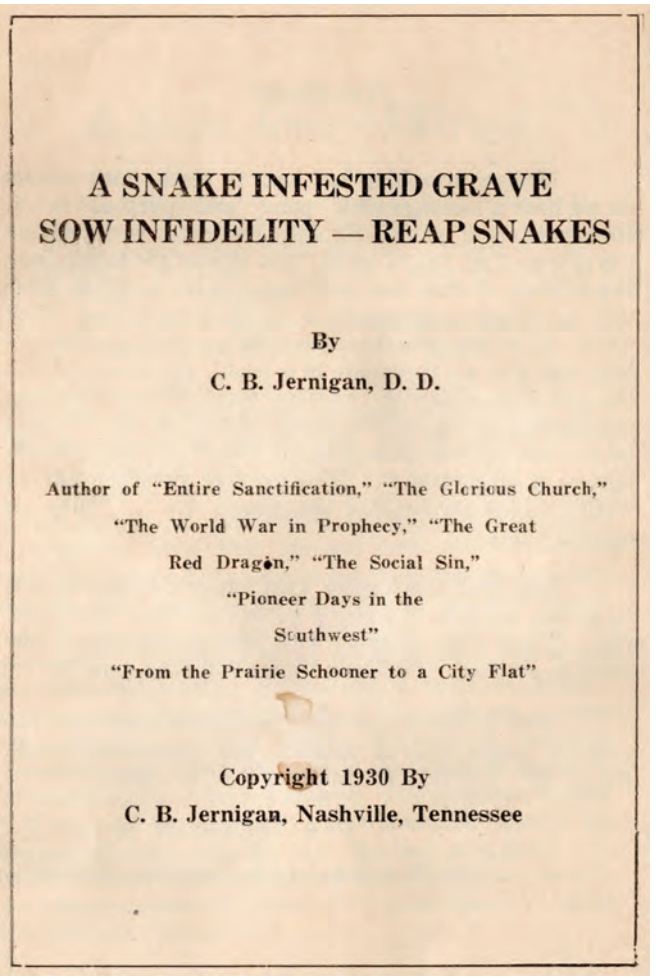

A SNAKE INFESTED GRAVE
SOW INFIDELITY — REAP SNAKES
By
C. B. Jernigan, D. D.
Author of "Entire Sanctification," "The Glorious Church,"
"The World War in Prophecy," "The Great
Red Dragon," "The Social Sin,"
"Pioneer Days in the
Southwest"
"From the Prairie Schooner to a City Flat"
Copyright 1930 By
C. B. Jernigan, Nashville, Tennessee

Fig. 6. *A snake infested grave* by C.B. Jernigan. 1930. Title page.

the manuscript. Christopher Bell sent additional information on Chester Bedell's monument in Berlin, Ohio.

Notes

1. The complete eulogy, in which snakes are not even mentioned, can be found at: https://www.findagrave.com/memorial/104280973/chester-bedell
2. The dispatch is entitled *An Infidel with a Flourish* and is dated 14 July 1938. It was reprinted by Nichols (1989) on pp. 79–81. Ernie Pyle's dispatches were syndicated in newspapers throughout the country.
3. The author of the undated tract is not indicated, but was likely Gerald Winrod. This story was originally published in *The Defender*, a publication of the Defenders of Christian Faith, Wichita, Kansas. The exact publication date is not known, but would have been in the early 1930s. Author's collection.

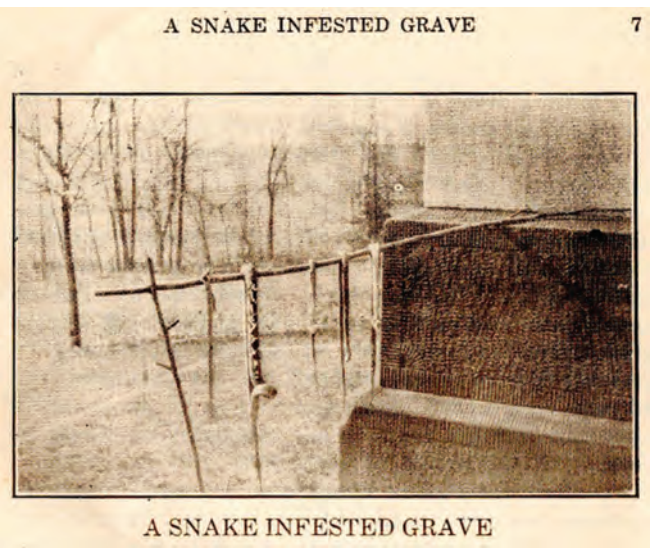


Fig. 7. Photo of snakes allegedly killed on Bedell's grave as published in Jernigan (1930). In other reproductions of the photo (e.g., Smith, 1952), the pattern on the larger snake is not evident.

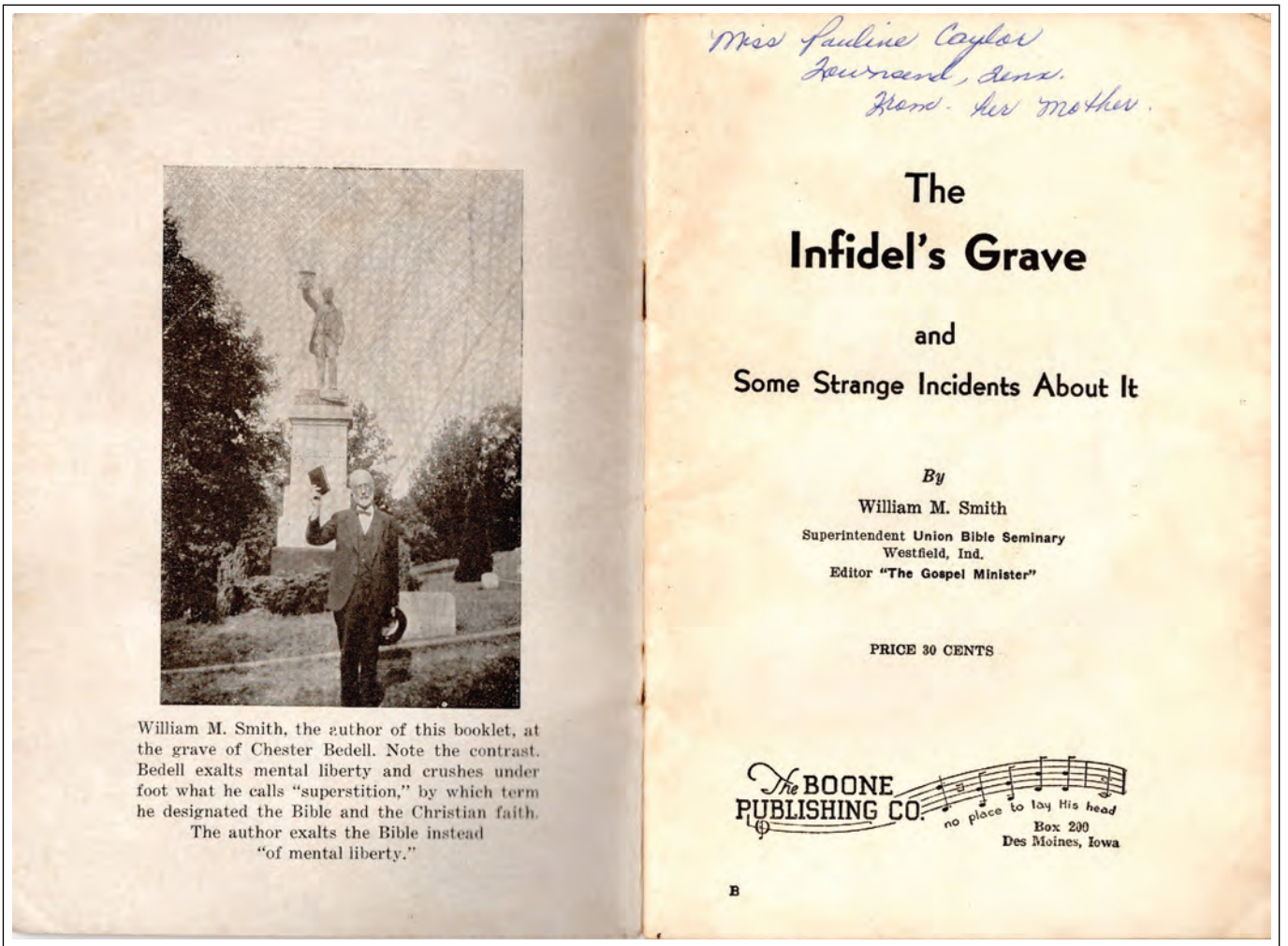

Miss Pauline Taylor
Tournand, Penn.
Friend. Her Mother.
The
Infidel's Grave
and
Some Strange Incidents About It
By
William M. Smith
Superintendent Union Bible Seminary
Westfield, Ind.
Editor "The Gospel Minister"
PRICE 30 CENTS
The BOONE PUBLISHING CO.
no place to lay His head
Box 200
Des Moines, Iowa
B
William M. Smith, the author of this booklet, at the grave of Chester Bedell. Note the contrast. Bedell exalts mental liberty and crushes under foot what he calls "superstition," by which term he designated the Bible and the Christian faith. The author exalts the Bible instead "of mental liberty."

Fig. 8. *The infidel's grave and some strange incidents about it* by William M. Smith. 1952 edition by the Boone Publishing Company. Title page. Smith standing in front of Chester Bedell's grave raising his Bible in contrast to Bedell's Universal Mental Liberty stance.

4. Smith's booklet originally appeared in *The Gospel Minister* in 1933, published by Union Bible Seminary, Westfield, Indiana, of which he was the editor. In 1952, a second edition was published (44 pp. + 2 photographs) that was updated with an appendix (The Testimony of Witnesses) and the two photos mentioned above. 10,000 copies of this edition were printed by the Boone Publishing Company, Des Moines, Iowa. The booklet was reprinted again in 1956 (38 pp.) by the Walfred Publishing Company, Philadelphia, Pennsylvania, although the publisher is not indicated on the booklet. The photographs are not included in the 1956 edition. Author's collection.
5. More information on Chester Bedell and the snakes in an atheist's grave legend can be found in the following sources. Note that there are many websites that provide misinformation, uncorroborated sightings, and exaggerated folklore concerning Chester Bedell and his grave.
   a. *Legends surrounded grave site of original owner of Woolman farm*. The Alliance Review, 7 September 2009. https://www.the-review.com/story/news/2009/09/08/legends-surrounded-grave-site-original/19187769007/.
   b. Hartzell Cemetery. *The Legend of the Snakes*. https://strongspage.com/places/chester-bedell/.
   c. Several versions of the story (*Infamous Infidel, Chester Bedell troubles from beyond the grave*, The Record-Courier, Ravenna, Ohio, 28 October 1990; Mark J. Price, *Snake legend slithers around 1908 grave in Deerfield*, Akron Beacon Journal, 29 December 2008, pp. B1, B4; updated 17 June 2011) and a reprinting of the Winrod tract text are available online at: https://en.believethesign.com/index.php/Snakes_infest_an_atheist%27s_grave
   d. *Chester Bedell was someone special*. Yesteryears 1(49):1–2. Salem Public Library, Ohio, 12 May 1992. http://history.salem.lib.oh.us/SalemHistory/Yesteryears/1992/Vol1No49May12op.pdf. This article provides excerpts from Bedell's very rare book.

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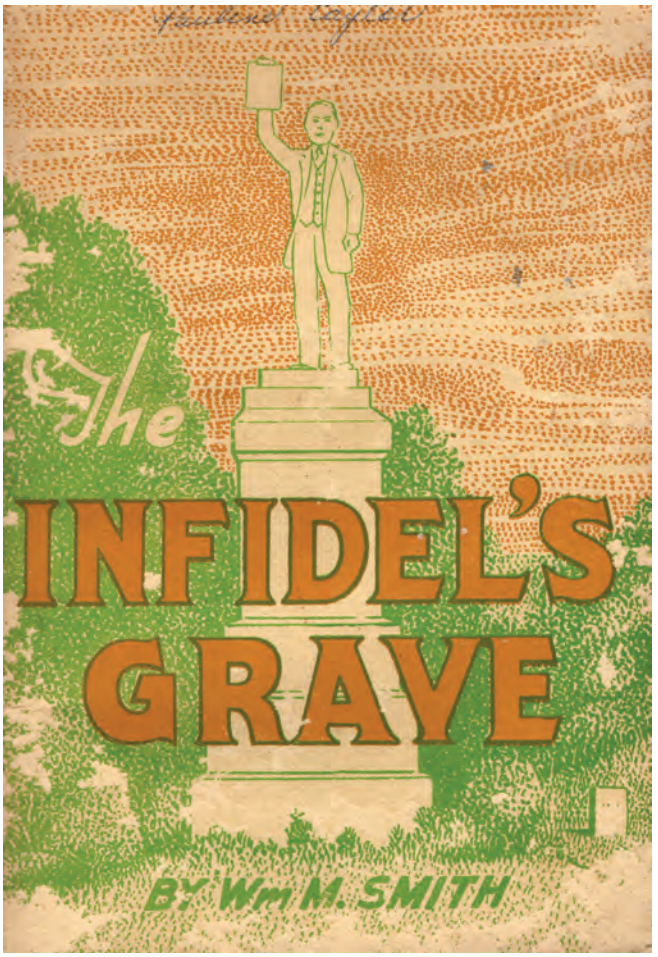

Fig. 9. *The infidel's grave and some strange incidents about it* by William M. Smith. 1952 edition by the Boone Publishing Company. Cover.

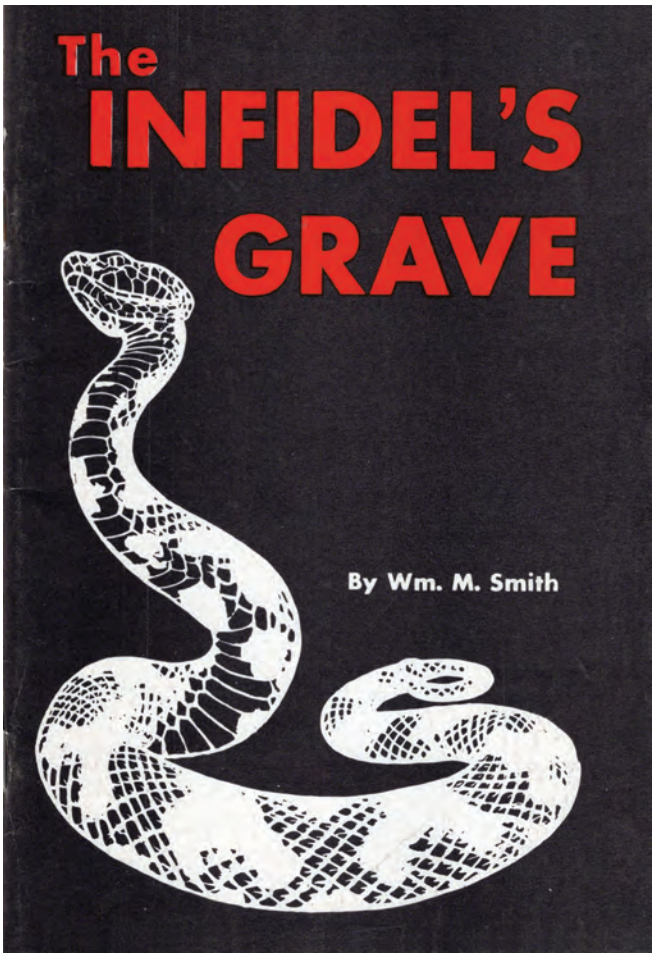

Fig. 10. *The infidel's grave and some strange incidents about it* by William M. Smith. 1956 edition by the Warfred Publishing Company. Cover. There are no illustrations or photographs in this edition.

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International Society for the History and Bibliography of Herpetology
International Society for the History and Bibliography of Herpetology

Book Review

J.G. Schneider's *Historiae Amphibiorum*: Herpetology at the Dawn of the 19th Century

Aaron M. Bauer and Esteban O. Lavilla
Contributions to Herpetology, Volume 32
Society for the Study of Amphibians and Reptiles (SSAR), Ithaca,
New York. 2022. xvii, 777 pp. ISBN 9781946681010

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Seventeen years after Aaron M. Bauer, together with Rainer Günther and Meghan Klipfel (1995), presented a monograph on the life and work of Wilhelm Peters (1815–1883) in which all the publications of this great and prolific herpetologist were reproduced as facsimile prints, Bauer now published another historical-herpetological milestone work, this time together with Esteban O. Lavilla. This volume is also part of the *Contributions to Herpetology* series published by the *Society for the Study of Amphibians and Reptiles* (SSAR). This new book deals with the legacy of the great philologist and zoologist Johann Gottlob (Theaenus) Schneider (1750–1822) whose most important herpetological work was the two volumes of his *Historiae Amphibiorum* (1799 and 1801). Bauer and Lavilla undertook the task to provide a full English translation of this great work originally written in Latin. They did not limit themselves to a translation alone, but enriched it with numerous footnotes explaining or deepening the understanding Schneider's text. These footnotes are incredible 1748 (!) in number and containing a lot of information. In some cases the footnotes require more space than the translated text, more than half a page of the original text they are commenting on.

These footnotes provide lots of details, not only on the taxa treated by Schneider and their nomenclatural histories but also on the earlier authors whose works he had studied; and because he was also (or even primarily) a great philologist, he dealt with contributors to the natural history of amphibians and reptiles dating back to Greek and Roman antiquity whose works he could of course read in their original languages. Schneider also often cited his contemporary colleagues in connection with the institutions they were affiliated or which they had founded. There were many privately founded natural history cabinets in those days in Europe called "Musea" (e.g. Museum Blochianum (Berlin), Museum Lampianum (Hannover), Museum Linckianum (Leipzig), Museum Meyerianum (Szczecin), and many others). Less common were institutional museums such as the "Museum Goettingense" Göttingen, which is, by the way, among the oldest institutional collections of this kind.

I was, in 1977, responsible for the transfer of the historically most valuable, alcohol-preserved herpetological collection of this museum to the Museum Koenig in Bonn, I also inherited the responsibility for preserving the history of this collection. To meet this objective, I researched this history (Böhme 2014) and quickly became aware that not only the earliest but also historically the most important visiting naturalist who worked with material from this collection was Johann Gottlob Schneider. So the numerous (no less than 24) references to the "Göttingen (University) Museum" or "University of Göttingen" in the Institutional Index of Bauer's & Lavilla's translation of Schneider's great work were the most intriguing and interesting ones for me. They referred to the original descriptions and consequently to type material of several well-known amphibian and reptile species: *Calamita punctatus* (= *Boana punctata*: extant); *Scincus brachypus* (= *Lygosoma quadrupes*: lost); *Scincus laticeps* (= *Plestiodon laticeps*: extant); *Boa carinata* (= *Candoia carinata:* extant); *Boa reticulata* (= *Malayopython reticulatus*: lost); *Boa rhombeata* (= *Malayopython reticulatus*: lost); *Crocodilus porosus* (= *Crocodylus porosus*: extant); and *Crocodilus trigonatus* (= *Palaeosuchus trigonatus*: extant). Some of the lost specimens, including a huge head of *Boa constrictor* ("caput ingens" of "*Boa constrictrix*") were already missing when Adolph Arnold Berthold started to compile the first catalogue of the Göttingen collection from 1840 onwards (see Berthold 1846).

This example of Schneider's use of the Göttingen collection is only one, even a smaller one, among numerous others, referring to the many other collections he worked with, so that the reader can get an idea of the wealth of information contained, in the same way for all other sources and institutions Schneider had used; not only in Schneider's work

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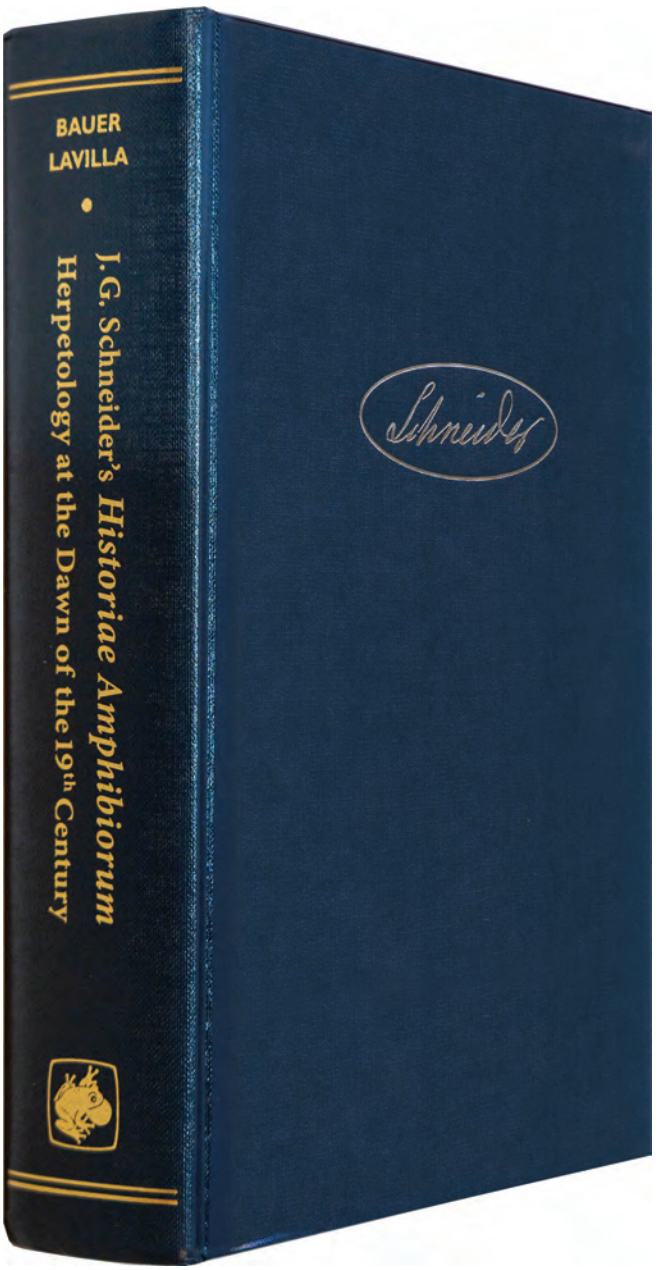
itself which is now accessible in the most important living language, but also in its evaluation and rich supplementation added by the two translaters and editors in their numerous footnotes.

A second aspect which found my particular interest was Schneider's treatment of Laurenti's (1768) three urodelan nomina *Proteus tritonius*, *Salamandra atra* and *Triton alpestris*. With closely adjoining type localities. The first name is a nominal taxon based on a specifically unidentifiable drawing of a larva which has subsequently been synonymized with *Triton alpestris*, reproduced in the present volume on pl. 17. The translation of the type locality "in alpe" as plural, meaning a part of the Alps, corroborates the view that *P. tritonius* is a doubtful name (nomen dubium) which can therefore not be used as an argument for the current denomination of the Alpine Newt as *Ichthyosaura alpestris* (see Rösler & Böhme 2022, Mutz & Böhme, submitted). However, in one sentence of this paragraph I would also suggest a slightly different translation. Laurenti's original reads (on p. 43): "Venter rubet a transparente rubello pulmone", translated as: "The belly is red and the pink lungs are seen by the transparency [of the abdomen]". I would rather say: "The belly gets red by a transparent reddish lung".

The whole text of this voluminous work has a very careful typesetting and it is extremely difficult to find a typing error or misprint. Among the few examples are "Schnieder" instead of Schneider (twice on p. xxxv), "Die gefrichelte [instead of "gestrichelte"] Natter" (on p. xlviii) or the name "Chalkokondylos, Demetrios" on p. 454. For 500 pages text this means practically none!

However, this volume has still 277 pages more, adding to its impressive appearance (and weight). These are facsimile prints of illustrations or plates of works cited und used by Schneider giving the book considerable added value. In conclusion, they make this book even more useful and justify calling it another milestone in the literature on the history of herpetology.



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Bibliotheca Herpetologica

Mark Catesby's Snakes of Carolina: A Review

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Introduction

With his 1747 two-volume work, *The Natural History of Carolina, Florida and the Bahama Islands*, (*The Natural History*) Mark Catesby published the first illustrated guide to a North American flora and fauna. He illustrated, in color, over 400 plant and animal taxa including twenty he identified as snakes, although one of them (his plate 59) is actually the Eastern Glass Lizard (*Ophisaurus ventralis*) and is not reviewed herein. Beginning with Linnaeus (1758, 1766), identification of some of the remaining nineteen has been uncontroversial, and others problematic. His plate 58 (the Wampum Snake), continues to elude complete confidence in its identification. Reveal (2015) wrote "Taxonomic disagreements among experts, especially regarding the identity of Catesby's fishes and snakes, exist and are bound to continue." Although he was known to have preserved snakes in alcoholic spirits, specimens are not known to be extant (McBurney 2021), and Linnaeus's system of using ventral and subcaudal scale counts to classify snakes was developed decades after Catesby's work. Each of his accounts includes a color figure of the snake in question, an English language name, a Latin descriptive name, and a description that most often includes color, pattern, size, and natural history notes.

Background

Catesby (1682–1749), an English naturalist-artist, traveled to North America twice over a fourteen year period. He sailed to Williamsburg, Virginia in 1712 where he resided until 1719 and, while there, collected plant specimens for shipment to botanists in England. Otherwise, little is known about his time or travels in Virginia. Later, regarding *The Natural History,* he wrote that he had done nothing during his Virginia time toward its publication (Catesby 1743). That he had painted natural history subjects, however, is evidenced by a letter from English apothecary Samuel Dale to botanist William Sherard, dated Oct. 15, 1719 which states: "Mr. Catesby is come from Virginia [...] He intends againe to return, and will take an opportunity to waite upon you, with some paintings of Birds etc., which he hath drawn" (Frick & Stearns 1961).

Dale and Sherard helped him win financial backing for a return to America, and in May 1722 he arrived in the Carolina colony at Charles Town (Frick and Stearns 1961). After exploring the colony through 1724, collecting specimens and sketching with a view to publishing *The Natural History*, he moved to the Bahamas where he similarly worked through 1725 (Catesby 1743). Following his return to England in 1726, he turned his sketches into finished watercolors, learned to etch the copper plates used for printing, and hand-colored the resulting prints himself, or supervised and touched up the work of others (Frick and Stearns). Each of his two volumes initially contained one hundred plates, issued in twenty plate fascicles as each fascicle was completed from 1729 to 1743. Overstreet (2015) identified the dates of issue: Volume I with the first hundred plates was completed in 1732, the second hundred of Volume II in 1743, with the snakes having been presented in April, 1737 as plates 41 through 60 of the second Volume. He added twenty plates as an appendix to Volume II in 1747 to complete the work.

Later English language editions have been published, beginning with a revised, second edition in 1754 edited and published by naturalist George Edwards. Bookseller Benjamin White added a third in 1771 that included an index attributed to Edwards wherein he matched Catesby with Linnaeus's *Systema Naturae* (McBurney 2021). A facsimile of the 1771 edition was published in 1974 wherein Ewan also matched Catesby with Linnaeus. In 1996, Alecto Historical Editions (AHE) published the original watercolors upon which the etched plates used for printing the earlier editions had been based. These watercolors, which were purchased by King George III in 1768, most closely represent Catesby's intent and are today conserved in the Royal Library, Windsor Castle, England (McBurney, 1997). The AHE prints were used by Reveal (2009, 2012, 2013, 2015) to match Catesby's flora and fauna with Linnaean binomials.

Methods

I examined all English language editions of *The Natural History*. The 1747 edition at the University of South Carolina Library and at the Library of Congress, the 1771 edition at the University of South Carolina Library, the 1974 edition in my personal library and the 1996 AHE prints at the Library of Congress. I viewed first (1747) and third (1771) editions held by the Smithsonian Libraries through the Biodiversity Heritage Library, and a second (1754) edition held by the Missouri Botanical Garden, Peter H. Raven Library, also through the Biodiversity Heritage Library. A comparison of AHE prints with earlier editions reveals that Catesby deviated from

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his original watercolors in some instances when he etched the plates, usually in minor ways, but significantly with one (plate 43, the Water Viper). Figures herein identified as the work of Catesby were provided by the Royal Library and are referred to as watercolors, and those from the first edition held by the Smithsonian Libraries provided by the Biodiversity Heritage Library, which are identified as etchings.

Cafferty (2007) thought him "one of the most influential naturalists of the early 18th century," and since *The Natural History* was the first illustrated guide to a North American flora and fauna, he was often cited by late 18th and early 19th century herpetological authors. I reviewed twelve such authors along with two more recent, each of whom had listed at least ten of Catesby's snakes, and compared their identifications. Beginning with Linnaeus (1758, 1766), I included Edwards (1771), Forster (1771), Pennant (1787), Gmelin (1789), Lacépède (1789), Sonnini and Latreille (1801), Shaw (1802), Daudin (1803), Harlan (1827), Holbrook (1842), Duméril, Bibron, and Duméril (1854), Ewan (1974), and concluded with Reveal (2015).

Catesby (1743) gave lengths in feet for some snakes, with others given in relation to these, and referenced the size of the "figure" he had created for several more. To determine approximate lengths for the latter, I measured their plate dimensions in a first edition, created a scale for measurement, and used braided wire to overlay the applicable figures. Each such figure was measured three times and the mean is given in Table 1. Table 1 compares lengths given by Catesby with those given by more recent authors for twenty-two current taxa as, I propose, several of his nineteen represent more than one species. That only two of his lengths fall outside those known for the same snakes today suggests he was a reliable reporter for that characteristic.

All references to his plates use spelling, punctuation, and capitalization from a first edition examined at the Library of Congress. References to current North American taxa follow Crother (2017) with the exception of not combining the noun snake to its descriptor, as with corn snake versus cornsnake. I refer to AHE plates as watercolors and to those of all earlier editions as etchings.

Discussion

While in Virginia, Catesby resided in the Tidewater settlement of Williamsburg. Beyond a 1714 trip through Virginia's Piedmont in an attempt to discover the source of the James River, wherein he and companions entered the Appalachian Mountains, we can only speculate regarding his travels in the remainder of the colony. While in Carolina, he explored both Tidewater and Piedmont regions, and described the nature of the rivers above and below the fall-line along with the variety of aquatic and terrestrial habitats he encountered. He also made at least two trips from Charles Town to Fort Moore along the Savannah River (near the current site of Augusta, Georgia), followed that river further inland, and might have reached the Appalachians again (Catesby 1743; Hurley 2015).

Catesby likely knew of two lists of the snakes of Virginia published by Clayton (1688) and Beverley (1705), and he certainly knew of a list of the snakes of Carolina published by Lawson (1709), although he acknowledged none of the three regarding snakes. That he knew of Lawson's work is evidenced by that fact that he cited Lawson in his discussion of Native Americans in *The Natural History.* He also paraphrased Lawson in at least two of his snake accounts. Snakes listed by Clayton, Beverley, and Lawson are compared with Catesby plate numbers where possible in Table 2. Several additional snakes listed by Lawson are not included in Table 2 since they do not match a Catesby plate.

His skills as an observer and artist have been addressed by earlier reviewers and their findings are germane. Holbrook (1842), "Justly regarded as the Father of American Herpetology" (Adler 1989), wrote "Catesby did much for natural history, though his drawings were done in the infancy of art, as applied to this subject, and those of his reptiles and fishes are the very worst part of his work." Although his work has received considerable praise, the Catesby literature notes two types of errors in *The Natural History*: inattention to detail, and combinations of two species or subspecies into one.

Alexander Garden, who collected in Carolina for Linnaeus, when asked by Linnaeus to examine Catesby's fishes, replied regarding the Mullet ". . .you may immediately perceive that he not only has forgotten to count and express the rays of the fins, but that he has [...] left out the pectoral fins entirely, and overlooked one of the ventral ones" (Frick and Stearns 1961). Frick and Stearns added "Most of the birds in The Natural History of Carolina are recognizable, but only because of their gross details. In smaller matters — wing and tail markings — Catesby was inaccurate, if, indeed, he drew them at all." Bauer (2015) wrote "His images and observations were imperfect, sometimes lacking important details or (rarely) confounding fact and fiction, or confusing the attributes of one species for those of another. [and] Catesby's description of the 'Cat Fish' was apparently written from memory and was based on more than one species." [noting further that] "The 'Cat Fish' was copied from a sixteenth century painting attributed to John White." Frick (1974) added "Some [plates] combined elements of closely related animals," and, specific to birds, Frick and Stearns wrote "some of Catesby's figures were composites of subspecies and some, indeed, of species."

Nonetheless, Catesby personally searched out, collected, illustrated, and described most of the more than 400 taxa depicted in the 220 plates of *The Natural History* and he received well-earned accolades during both his time and our own. Frick and Stearns, in their 1961 book *Mark Catesby: The Colonial Audubon*, noted "Catesby considered himself to be first of all a botanist [but] his lasting fame has depended principally on his contributions as an ornithologist," and Stearns (1970) added that he has been considered by some as "the founder of American ornithology." More recently, Means (2017) dubbed him "the father of American natural history."

Table 1. Comparison of snake lengths given by Catesby (1743) with those given for the same taxa by recent authors. *1. Martof et al (1980); *2. Ernst and Ernst (2003); *3. Merel J. Cox et al (1998).

Plate	Catesby's English Name	Length given by Catesby	Est. size	Proposed identification & current accepted length
41	Rattle-Snake	The largest Viper. Largest he saw was 8 ft.	n/a	*Crotalus horridus*: 36-72"(*1). Composite design with *Crotalus adamanteus*: 42-78"(*1) to 99"(*2).
42	Small Rattle Snake	Smaller than the Rattle-Snake	n/a	*Sistrurus miliarius*: 15-26"(*1).
43	Water Viper	The second largest Viper	n/a	*Nerodia fasciata*: 24-55" (*1) composite design with Agkistrodon piscivorus: 30 to 71"(*1)
44	Black Viper	About 2 ft.	n/a	*Heterodon platirhinos*: 20-47"(*1). Perhaps a composite image with *Agkistrodon piscivorus*: 30 to 71"(*1).
45	Brown-Viper	About 2 ft.	n/a	*Agkistrodon contortrix*: 24-45"(*1). Perhaps a composite design with a *Nerodia* (species).
46	Copper-belly Snake	Sometimes near size of the Rattle-Snake	n/a	*Nerodia erythrogaster*: 30-60"(*1).
47	Bluish-green Snake	About size of figure	41 in.	*Ahaetulla nasuta*: to 50"(*3).
48	Black Snake	Up to 6 ft.	n/a	*Coluber constrictor*: 36-66"(*1) to 75"(*2).
49	Little Brown Bead-Snake	Always small	n/a	*Storeria dekayi*: 9-18"(*1).
50	Ribbon-Snake	Not much bigger than figure	35 in.	*Thamnophis saurita*: 18-38"(*1).
51	Spotted Ribbon-Snake	About size of figure.	26 in.	*Thamnophis sirtalis*: 18-42"(*1).
52	Chain-Snake	Size of figure	37 in.	*Lampropeltis getula*: 36-69"(*1).
53	Green Spotted Snake	Sometimes 4x figure (4x = 96")	24 in.	*Pantherophis quadrivittatus*: 42-85"(*1) to 101"(*2). Composite design with *Thamnophis sirtalis*: 18-42"(*1).
54	Coach-whip Snake	Sometimes 2x figure (2x = 114")	57 in.	*Coluber flagellum*: 48-94"(*1) to 102"(*2).
55	Corn Snake	Sometimes 2x figure (2x = 66")	33 in.	*Pantherophis guttatus*: 30-72"(*1).
56	Hog-nose Snake	Seldom larger than figure	15 in.	*Heterodon simus*: 13-22"(*1).
57	Green Snake	Size of figure	31 in.	*Opheodrys aestivus*: 22-36"(*1).
58	Wampum Snake	Up to 5 ft.	n/a	*Drymarchon couperi*: 42-85"(*1). Composite design with perhaps *Pantherophis quadrivittatus* 42-85"(*1) to 101"(*2) and/or *Farancia abacura* 40-73"(1) to 81"(2).
60	Bead Snake	Size of figure, some 3-4x (3-4x = 69"-92")	23 in.	*Cemophora coccinea*: 14-26"(*1). Composite design with *Micrurus fulvius*: 20-35"(*1) to 47" (*2).

Table 2. Snakes listed by Clayton, Beverley, and Lawson matched with Catesby plate numbers.

Catesby plate and name with proposed identification	**Clayton (1688, Virginia)**	**Beverley (1705, Virginia)**	**Lawson (1709, Carolina)**
41. Rattle-Snake: *Crotalus horridus* composite design with *Crotalus adamanteus*	Rattle-snake: *Crotalus horridus*	Rattle-snake: *Crotalus horridus*	Rattle-snake: *Crotalus horridus*
42. Small Rattle Snake: *Sistrurus miliarius*			Ground Rattle-snake: *Sistrurus miliarius*
43. Water Viper: *Agkistrodon piscivorus* composite design with *Nerodia fasciata*.	Water-snake: *Nerodia sipedon*	Water-snake: *Nerodia sipedon*	Swamp-snake ("3 sorts"): Includes *Agkistrodon piscivorus*. Water-snake ("4 sorts"): includes *Nerodia sipedon*
44. Black Viper: *Heterodon platirhinos* perhaps a composite design with *Agkistrodon piscivorus*.	Blowing-snake: *Heterodon platirhinos*	Black Viper-snake: *Heterodon platirhinos*	Viper ("2 sorts"): Both "sorts" are *Heterodon platirhinos*.
45. Brown Viper: *Agkistrodon contortrix* perhaps a composite design with a Nerodia species.	Red-snake: (uncertain). Perhaps *Agkistrodon contortrix* or *Pantherophis guttatus*.		Red-belly Land-snake (describes two types): one said to be venomous, perhaps *Agkistrodon contortrix*. The other said to be non-venomous.
46. Copper-belly Snake: Nerodia erythrogaster.		Copper-bellied Snake: *Nerodia erythrogaster*	Swamp-snake ("3 sorts"): Includes *Nerodia erythrogaster*
48. Black Snake: *Coluber constrictor*	Black-snake: *Coluber constrictor*	Black-snake: *Coluber constrictor*	Long Black-snake: *Coluber constrictor*
53. Green Spotted Snake: *Pantherophis quadrivittatus* composite design with *Thamnophis sirtalis*.			Chicken- or Egg-snake: *Pantherophis quadrivittatus*
55. Corn Snake: *Pantherophis guttatus*.	Corn-snake: (not *Pantherophis*)	Corn-snake: (not *Pantherophis*)	Corn-snake: (not *Pantherophis*)
57. Green Snake: *Opheodrys aestivus*.			Green-snake, *O. aestivus*
58. Wampum Snake: *Drymarchon couperi* composite design with perhaps *Pantherophis quadrivittatus* (black phase) and/or *Farancia abacura*.			King-snake: Likely *Drymarchon couperi*.

Even so, his observation skills have been described at a level that is not supported by his work with Carolina's snakes. Neal (2015) wrote "the one characteristic that stands above all the rest is [his] phenomenal powers of observation and recall. [and] I suspect he had a photographic memory." According to Adler (2015) "Catesby correctly reported that there were two species of greensnakes in eastern North America [and] had a keen eye for differences." Later discussion will question the green snake identities, but it is within the realm of water snakes that Catesby can be seen to have missed much. He described Carolina's rivers, streams, ponds, marshes and swamps in some detail, but identified only two water snakes: the Water Viper (plate 43) and the Copper-bellied Snake (plate 46). A list of water snakes known from the Tidewater and Piedmont areas of the Carolinas compiled from Gibbons (2017) includes nine, and Catesby's recognition of only two suggests a cursory examination of this assemblage. Lawson (1709) had listed eight he referred to as either swamp or water snakes.

Regarding his artistic methodology, McBurney (2015) suggested that "When conditions were not right to use watercolor in the field, Catesby could resort to annotating his monochrome drawing with color notes . . . for painting the colors later . . ." That some of the problematic identifications discussed below might be due to his having relied on monochrome drawings with inadequate color notes (and memory) is likely. However, Catesby (1743) wrote ". . . Reptiles will live many months without sustenance; so that I had no difficulty in painting them while living," suggesting that he maintained at least some in captivity. McBurney (2021) introduced another plausible, even more likely, explanation for identification problems. In her discussion of his preference for drawing live specimens, she added "The result was usually a synthetic image created from observation of many different exemplars rather than a portrait of an individual specimen." After a reassessment of his work from this point-of-view, it seems likely that Catesby failed, or was reluctant, to recognize species similar in appearance and habit at times.

His uncertainty with species identity is clearly expressed with plates 41 (Rattle-Snake) and 42 (Small Rattle-Snake) which he was hesitant to identify as different species, writing: ". . .I have observed, that some kinds change their marks and colours as they cast off their *Exuviae*; others, at the shedding of their *Exuviae*, retain their colours, particularly those that are of one colour. [and] All kinds of Serpents, at mature age, retain their specific colours. It is while they are young and growing, that some of them are differently marked at the change of their *Exuviae* . . ." (See also discussion of Plate 42 below.) He expressed similar uncertainty with plates 51 (Spotted Ribbon-Snake) and 53 (Green Spotted Snake), but most clearly illustrated it with plate 43 (Water Viper), wherein he depicted *Agkistrodon* (in part) in the original watercolor but *Nerodia* in the derived etching (Catesby 1743, AHE 1996).

Wilson (1971) wrote "Illustrations such as Catesby's fulfilled for the eighteenth century the role that photography fills today, that of exact representation." Indeed, Catesby himself considered that his illustrations would provide the means to identify the taxa in question, rendering lengthy descriptions unnecessary, and suggested that the brief descriptions he offered would suffice (Catesby 1743). His snake designs might be seen as relatively crude when measured against modern efforts and resist citation as exact representations, but they are generally realistic and reliable insofar as comparative length to girth proportions, head-neck width differences, and relative tail lengths are concerned.

However, as seen in 3, there are cases where neither his illustration nor his description have proven adequate. Resolution of identification problems experienced by previous reviewers requires recognition that they likely approached their task with an assumption that each of his plates represented a single species. I propose, however, that due to ontogenetic uncertainty, use of more than one specimen to represent a given species, and reliance on memory in some cases, several of his snakes are composites. Though none have been previously identified as such, Shaw (1802) and Holbrook (1842) hinted at the possibility regarding plates 53 (Green Spotted Snake) and 60 (Bead Snake) respectively.

Table 3 compares the identifications made by all fourteen authors consulted against those proposed herein. Only four of his snakes were listed by all: the Small Rattle-Snake (plate 42), Black Snake (plate 48), Hog-nose Snake (plate 56), and Green Snake (plate 57). At the polar extreme, only three of the fourteen consulted authors listed the Little brown bead Snake (plate 49), and, measured against the identifications proposed herein, none of the nineteen were agreed upon by all.

Catesby's Snakes

Although he declared four of his snakes to be vipers he named five: the Rattle-Snake (plate 41), Small Rattle-Snake (plate 42), Water Viper (plate 43), black Viper (plate 44), and Brown Viper (plate 45). The discrepancy stems from his unwillingness to declare the Rattle-Snake and Small Rattle-Snake to be different species. Four of the five are pit vipers (Crotalinae), yet he neither mentioned nor illustrated facial pits.

Plate 41, The Rattle-Snake, *Vipera Caudisona Americana* (Fig. 1).
Previous identifications: *Crotalus durissus, Crotalus horridus.*
Proposed: *Crotalus horridus* Linnaeus, 1758, composite with *Crotalus adamanteus* Palisot de Beauvois, 1799, due to Catesby's written account.

Linnaeus (1758, 1766) named both *Crotalus horridus* and *Crotalus durissus* from the Americas but cited Catesby for neither, and it was only in the twentieth century that the issue was settled as to which Linnaean binomial was appropriate to Eastern North America's most wide-ranging rattlesnake, (Klauber 1941). Edwards (1771), Forster (1771), Pennant (1787), Lacépède (1789), Shaw (1802), Ewan (1974), and Reveal (2015) chose *Crotalus horridus*, while Gmelin (1788),

Fig.1. Catesby Plate 41, The Rattle-Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Soninni and Latreille (1801), Daudin (1802), Harlan (1827), Holbrook (1842), and Duméril, Bibron and Duméril (1854), chose *Crotalus durissus*, but all cited Catesby 41. While this is a reasonable representation of *Crotalus horridus*, McBurney (2021) tells us the design was not his own, having been copied from an earlier work by Nicolas Robert.

That he encountered *Crotalus adamanteus* without recognizing it as a separate species seems evidenced by his writing "The largest [Rattle-Snake] I ever saw, was one about eight Feet in Length, weighing between eight and nine Pounds" (Catesby 1743). Klauber (1956) offered rattlesnake weights related to lengths that, while not species-specific, suggested an eight foot rattlesnake would weigh twenty-three pounds, and one of eight to nine pounds would be, at minimum, six feet long (74.5 inches being the maximum for *Crotalus horridus* according to Ernst and Ernst, 2003). Based on Table 1, I suggested that he was generally reliable as to reported lengths, but he might have exaggerated this length somewhat, and might have over- or under-estimated the weight as well. In any case, I suggest he encountered *Crotalus adamanteus*. He worked within the range of this larger rattlesnake for two and one half years, and it seems unlikely he wouldn't have.

Plate 42, The Small Rattle-Snake, *Vipera caudisona Americana minor* (Figs. 2a, 2b).
Previous identifications: *Sibon nebulatus, Crotalus durissus, Sistrurus miliarius.*
Proposed: *Sistrurus miliarius* (Linnaeus, 1766).

Plate 42 is one of only two Catesby snakes cited by Linnaeus in the tenth edition (1758) of the *Systema Naturae*, but with doubt ("Catesb. car. 42?") under *Coluber* (= *Sibon*) *nebulatus*. *Sibon nebulatus*, native to Central to South America, matches this rattlesnake in no characteristic (Ward 2016). In the twelfth edition (1766) he cited it again, but with no doubt under *Crotalus miliarius*. The remaining thirteen authors, save Pennant, followed suit. Inexplicably, Pennant (1787) cited it under *Crotalus durissus* while, at the same time, recognizing *Crotalus* (= *Sistrurus*) *miliarius*.

Fig. 2a. Catesby Plate 42, The small Rattle Snake (watercolor) with erect fangs in the upper jaw. Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 2b. Catesby Plate 42, The small Rattle Snake (etching) with no fangs visible. Courtesy Smithsonian Libraries through Biodiversity Heritage Library.

Catesby (1743) wasn't certain that this and his larger rattlesnake were different species and wrote "Rattle-Snakes of this size being differently marked and coloured from the large ones [...] makes it generally concluded that they are different, though this is not sufficient to prove it [...] Whether this little Rattle-Snake be of a different species or not, must be left to future inquiry."

Plate 43, The Water Viper, *Vipera Aquatica* (Figs. 3a, 3b).
Previous identifications: *Diadophis punctatus, Nerodia taxispilota, Agkistrodon piscivorus.*
Proposed: *Agkistrodon piscivorus* (Lacepede, 1789), composite design with *Nerodia fasciata* (Linnaeus, 1766).

This plate was not addressed by Linnaeus (1766) or Gmelin (1788). Forster (1771), Pennant (1787), and Lacépède (1789), listed it with no matching Linnaean binomial. Edwards (1771) and Ewan (1974) matched it with *Coluber* (= *Diadophis*) *punctatus*, likely due to the yellow and black Catesby gave its ventrum. Neither the written description nor the illustration support *Diadophis punctatus*. Ewan also referred to it as the "Brown Water Snake" (*Nerodia taxispilota*) and, while *Nerodia* is applicable in a composite, it is more consistent with *Nerodia fasciata* at the species level. Apparently on the strength of the written description (below), Sonnini and Latreille (1801), Shaw (1802), Daudin (1803), Har-

Fig. 3a. Catesby Plate 43, The Water Viper (watercolor) with a wide and thick, viper-like head. Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 3b. Catesby Plate 43, The Water Viper (etching) with a non-viper-like head. Courtesy Smithsonian Libraries through Biodiversity Heritage Library.

lan (1827), Holbrook (1842), Duméril, Bibron and Duméril (1854), and Reveal (2009) identified this as *Agkistrodon piscivorus* (or a synonym) and were, in part, correct. Based on viewing ventrum descriptions of applicable *Nerodia* in Ernst and Ernst (2003), Gibbons and Dorcas (2004), and others, I propose that the etching (Fig. 3b), in all editions prior to the AHE, depicts *Nerodia fasciata*, but that the watercolor it was based on (Fig. 3a) is a composite of *Nerodia fasciata* and *Agkistrodon piscivorus.* The watercolor and etching depict the snake's body identically, whereas a distinct viper-like head seen in the watercolor (Fig. 3a) was replaced by an, also distinct, non-viper-like head in the etching (Fig. 3b).

Catesby's description is also composite (see previous discussion of his treatment of Carolina's aquatic snake assemblage): "The back and head of this Serpent is brown, The Belly marked transversly with black and yellow alternately, as are the Sides of the Neck. The Neck small, the Head large, armed with the like destructive Weapons as the Rattle-Snake [...] and contrary to most other Vipers are very nimble, and particularly dextrous in catching Fish. In summer great Numbers of these Serpents are seen lying on the Branches of Trees hanging over Rivers, from which at the Approach of a Boat, they drop into the Water. [And] many of them are large and coloured not much unlike the Rattle- Snake, and their bite is said to be as mortal."

Excepting the head, both etching and watercolor show the same heavy-bodied, brownish snake with black and yellow ventral colors exposed at the ventro-lateral angle. In the etching, the interior of the snake's open-mouth is red rather than white, its head is not viper-like, both jaws are depicted with rows of small teeth along the outer margins, and there are no fangs. However, the close-mouthed snake in the watercolor has a distinctly viper-like head (*Agkistrodon piscivorus*), and when he did the etching, Catesby replaced it with that of *Nerodia fasciata*. That he painted and described both *Agkistrodon* and *Nerodia* is clear. It seems reasonable to conclude that he examined *Agkistrodon piscivorus* and thereafter considered all water snakes, save the Copper-belly Snake (plate 46), to be the Water Viper, just as all are called "cottonmouth" or "water moccasin" in some areas even today (Jensen et al 2008; Mitchell, 1994). This might include any *Nerodia* of the Carolinas.

Plate 44, The black Viper, *Vipera negra* (Figs. 4a, 4b).
Previous identifications: *Vipera berus, Heterodon platirhinos, Agkistrodon piscivorus.*
Proposed: *Heterodon platirhinos* Latreille, 180, perhaps composite with *Agkistrodon piscivorus* (Lacepede, 1789).

This plate was not addressed by Linnaeus (1766), Gmelin (1788), Lacépède (1789), or Soninni Latreille (1801). Forster (1771) and Pennant (1787) listed it with no matching Linnaean binomial. Edwards (1771) cited it under the European snake *Coluber prester* (= *Vipera berus*), which it cannot be. Shaw (1802), Daudin (1803), Harlan (1827), Holbrook (1842), and Duméril, Bibron and Duméril (1854) correctly, but incompletely, cited it under *Heterodon platirhinos* (or a synonym). Ewan (1974) considered it the "Water Moccasin, *Agkistrodon p. piscivorus*," noting "the water moccasin is usually black." Reveal (2015) agreed with *Heterodon platirhinos* and added "[it is] often confused with the poisonous eastern cottonmouth . ."

Of this snake in Carolina, Lawson (1709) had written "People call these Vipers, because they spread a very flat Head at any time when they are vex'd [it is] black and short; and is reckon'd amongst the worst of Snakes, for Venom." Catesby (1737) paraphrased Lawson writing "This Serpent is short and thick, of slow Motion, spreads his Head, when irritated, surprisingly broad and flat, threatning with a horrid Hiss [...] They are very venomous, *having the like fangs of the Rattle-Snake,* and *their bite is said to be as deadly*" [emphasis added]. He depicted it in the original watercolor with fangs projecting at right angles from each side of its virtually

Fig. 4a. Catesby Plate 44, The Black Viper (watercolor) fangs projecting at right angles from the mouth. Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 4b. Catesby Plate 44, The Black Viper (etching) fangs projecting forward from the mouth. Courtesy Smithsonian Libraries through Biodiversity Heritage Library.

closed mouth (Fig. 4a), but, in the etching, depicted the fangs as projecting straight forward (Fig. 4b). In each, the fangs have the appearance of having been added as an afterthought.

Absent the fangs, this is *Heterodon platirhinos*. That he included fangs because the snake was reported in folklore to be venomous is possible. However, in his account of the Hog-nose Snake (plate 56) he wrote that he considered the Hog-nose to be a viper, but after fruitlessly searching for fangs, decided it was not. That he searched for fangs in the Hog-nose suggests he would have done so in this case. That he might have added the fangs in acceptance of folklore, or might have examined a black or very dark *Agkistrodon piscivorus,* found fangs, and added them to his already-drawn, black *Heterodon platirhinos* is, I suggest, probable. In which case, this is another composite, and Ewan's choice is validated in part. One of several "viper" characteristics noted by Catesby (1737) is that they "Swell head and neck when irritated." *Heterodon platirhinos* was almost certainly the source of this observation.

Plate 45, The Brown Viper, *Vipera fusca* (Figs. 5a, 5b).
Previous identifications: *Coluber luridus, Agkistrodon contortrix, Agkistrodon piscivorus, Nerodia fasciata, Heterodon platirhinos.*
Proposed: *Agkistrodon contortrix* (Linnaeus, 1766), composite design with a *Nerodia* species.

This plate was not addressed by Linnaeus (1766), Gmelin (1788), Lacépède (1789), Soninni and Latreille (1801), Daudin (1802), or Harlan (1827). Forster (1771) and Pennant (1787) listed it with no matching Linnaean binomial. Edwards (1771) and Ewan (1974) cited it under *Coluber luridus*, a taxon not currently recognized (Wallach, Williams and Boundy 2014). Shaw (1802) cited it under his *Coluber tisiphone*, a snake I consider synonymous with *Agkistrodon contortrix* following Gray (1830), who listed it as synonymous with Daudin's *Cenchris mokeson* (= *Agkistrodon contortrix*). Both Gray and Cuvier (1831) listed it as synonymous with Catesby's Brown Viper. It must be noted that the *Coluber tisiphone* of Shaw has been seen as synonymous with *Agkistrodon piscivorus* by others (Smith and David 1999; Wallach, Williams and Boundy). Holbrook (1842) thought it "probably only a dark *Tropidonotus fasciatus* (= *Nerodia fasciata*) before it has shed its skin," and Duméril, Bibron and Duméril (1854) followed suit. Reveal (2015) chose *Heterodon platirhinos* supported by Adler's observation that "because of its cobra-like head, [it] is locally considered to be poisonous."

Catesby (1743) wrote "The subject of this Plate is, as it appeared to me, at a great inundation, where, by the violence of the current, fish, reptiles, with other animals and insects, were dislodged from their holes, &c. floating upon heaps of vegetation . . ." He wrote of seeing such an inundation of the Savannah River at Fort Moore, and described this snake as: . . .in Length about two Feet, and large in proportion [...] a slow moving and sluggish reptile, advancing deliberately, even to escape Danger, yet will defend himself with much Fierceness when attacked, and the Bite is said to be as venomous as any [...] They are found in *Virginia* and *Carolina;* in the last of which places they are called the *Truncheon-Snake.* They prey on Lizards, Efts, and other Animals.

Elsewhere in *The Natural History*, he wrote of examining stomach contents of fish, lizards, alligators, and birds (Catesby 1743), and this account suggests he also dissected snakes, as Ernst and Ernst (2003) confirm lizards, salamanders ("Efts") and a variety of other animals are taken by *Agkistrodon contortrix*. In both watercolor and etching, it is heavy-bodied and open-mouthed with erect fangs in the upper jaw, with a viper-like head profile. Along with his notes on diet, there are other points favoring *Agkistrodon contortrix* over *Agkistrodon piscivorus*: no illustration of the white interior of the mouth or mention of it's display "when attacked;" the distribution of *Agkistrodon piscivorus* is limited to the extreme south of Virginia; and the appellation "Truncheon

Fig. 5a. Catesby Plate 45, The Brown-Viper (watercolor) with a distinct viper-like head. Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 5b. Catesby Plate 45, The Brown-Viper (etching) with a noticeably less viper-like head. Courtesy Smithsonian Libraries through Biodiversity Heritage Library.

Fig. 6. Catesby Plate 46, The Copper-Belly Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Snake" in Carolina where *Agkistrodon piscivorus* was known as the "Water Rattle Snake" (Catesby 1743). Problematic identification may be due to his depiction of no dorsal pattern. That there have been pattern-less *Agkistrodon contortrix* is confirmed by Gloyd and Conant (1990), although he may have conflated it with a unicolor *Nerodia*, perhaps *Nerodia fasciata,* as Holbrook thought, and relied on memory for his Virginia notation. As with the Water Viper (plate 43 above), Catesby altered the conspicuously viper-like head shape he depicted in his watercolor (Fig. 5a) to a design somewhat less viper-like (Fig. 5b)when he completed the etching, although both show erect fangs in an open mouth. Also mitigating against *Agkistrodon piscivorus* is the red interior of this snake's mouth in both renditions.

Plate 46, The Copper-belly Snake, *Anguis Ventre Cuprei Coloris* (Fig. 6).

Previous identifications: *Nerodia erythrogaster, Haldea striatula, Nerodia fasciata***.**

Proposed: *Nerodia erythrogaster* (Forster, 1771).

This plate was not addressed by Linnaeus (1766), Gmelin (1788) or Soninni and Latreille (1801). Forster (1771) and Pennant (1787) listed it with no matching Linnaean binomial. Edwards (1771), Shaw (1802), Holbrook (1842), Duméril, Bibron, and Duméril (1854), Ewan (1974), and Reveal (2015) cited it under *Coluber* (= *Nerodia*) *erythrogaster*. Lacépède (1789) cited it under *Coluber striatulus* (= *Haldea striatula*), perhaps due to the keeled scales depicted by Catesby, but it is too large to be *Haldea striatula,* as Catesby (1743) said "[they] sometimes approach near the size of the Rattle-Snake." Daudin (1803) and Harlan (1827) thought it *Coluber porcatus* (= *Nerodia fasciata*), but it has a brownish, pattern-less dorsum with the reddish ventrum of (formerly recognized) *Nerodia e. erythrogaster*, the Red-bellied Water Snake.

Plate 47, The bluish green Snake, *Anguis gracilis Caeruleo-Viridis* (Figs. 7a, 7b).

Previous identifications: *Ahaetulla mycterizans, Leptophis ahaetulla, Opheodrys aestivus.*

Proposed: *Ahaetulla nasuta* (Lacepede, 1789).

Linnaeus cited this in the 10th (1758) and 12th (1766) editions of the *Systema naturae* under *Coluber* (= *Ahaetulla*) *mycterizans*, with America its origin. Shaw, Holbrook, and Duméril, Bibron and Duméril did not address it. Edwards (1771) and Forster (1771) agreed with Linnaeus, as did Gmelin (1788), who added Asia to its habitat, but also cited it under *Coluber* (= *Leptophis*) *Ahaetulla*, of Central and South America. Lacépède (1789) chose *Coluber Ahaetulla*, but Pennant (1787) and Sonnini and Latreille (1801) chose *Coluber mycterizans*. Daudin (1802), Harlan (1827), and Reveal

Fig. 7a. Catesby Plate 47, The bluish green Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 7b. *Ahaetulla nasuta,* Creative Commons by Thai National Parks, CC 2.0.

Fig. 8. Catesby Plate 48, The black Snake (watercolor).

(2015) cited it under *Coluber* (= *Opheodrys*) *aestivus,* while Ewan (1974) listed it with no matching Linnaean binomial.

It is depicted with an extended, upwardly curving rostrum, and, in support of his identification, Reveal (2009) wrote "the slightly upwardly curved nose is distinctive of the rough green snake." Examining thirty-six North American, regional, and state guides from Ditmars (1939) to Camper (2019) I found none that support this descriptively or photographically. The totality of Catesby's design refutes *Opheodrys aestivus*, and suggests *Ahaetulla nasuta* as most likely. Table 4 shows my notes from viewing both watercolor and etching, and compares them with *Ahaetulla mycterizans*, *Ahaetulla nasuta*, and *Leptophis ahaetulla*. The dorsal color Catesby depicted does not strictly match any of the three, and the ventral color could fit either *Ahaetulla nasuta* or *Leptophis ahaetulla*. Presence of a distinct, longitudinal, ventro-lateral line, a character not possessed by *Opheodrys aestivus* (Ernst and Ernst 2003; Gibbons 2017), points to either *Ahaetulla mycterizans* or *Ahaetulla nasuta*. The deciding factor must be the extended rostrum that is upturned on some (not all) *Ahaetulla nasuta*, but on none of the others (Fig. 7b). Catesby (1743) said "The nose of this species turning up, sufficiently distinguishes it from another green Snake I shall hereafter describe." (This will be plate 57, *Opheodrys aestivus.*)

Although one of his better figures, the description is one of his sketchiest, noting only that is arboreal and feeds on insects. How he came into possession of it can't be known, but English ships were sailing and trading worldwide in his time. He would have had contact with ship's Captains and other sailors both while arranging for shipments of specimens to England from Carolina, and in receiving others after his return to England. Any number of plausible scenarios could place it in his hands.

Plate 48, The Black Snake, *Anguis niger* (Fig. 8).
Previous identifications: *Coluber constrictor, Pantherophis alleghaniensis.*
Proposed: *Coluber constrictor* Linnaeus 1758.

Beginning with Linnaeus, thirteen of fourteen authors cited this plate under *Coluber constrictor* (or a synonym). Reveal (2015), the only dissenter, cited it under *Pantherophis alleghaniensis* (= *Pantherophis quadrivittatus* in its Virginia and Carolina populations, Burbrink et al. 2021). Catesby would have encountered *Coluber constrictor* in Virginia and Carolina, and the black phase of *Pantherophis quadrivittatus* in Virginia but not likely in Carolina. He wrote: "[this is] a large and very long Snake, some being six Feet in Length

Table 3. Comparison of proposed identifications with those of fourteen authors in their attempts to identify Catesby's snakes (1766-2009). According to identifications proposed herein each author is noted as: C = correct; E = in error; P = correct in part; N = not matched to a Linnaean binomial; ? = uncertain of their identification. If blank the taxon was not listed by this author. Author abbreviations listed below.

Year and author abbreviations: 1766 Li (Linnaeus); 1771 Ed (Edwards); 1771 Fo (Forster); 1787 Pe (Pennant); 1789 Ge (Gmelin); 1789 La (Lacépède); 1801 Sl (Soninni & Latreille); 1802 Sh (Shaw); 1803 Da (Daudin); 1827 Ha (Harlin); 1842 Ho (Holbrook); 1854 Du (Duméril, Bibron, & Duméril); 1974 Ew (Ewan); 2015 Re (Reveal).

Catesby's plate number & name	**Year:**	**1766**	**1771**	**1771**	**1787**	**1788**	**1789**	**1801**	**1802**	**1803**	**1827**	**1842**	**1854**	**1974**	**2015**
	Author:	**Li**	**Ed**	**Fo**	**Pe**	**Ge**	**La**	**Sl**	**Sh**	**Da**	**Ha**	**Ho**	**Du**	**Ew**	**Re**
41. Rattle-Snake			P	P	P	P	P	P	P	P	P	P	P	P	P
42. Small Rattle Snake		C	C	C	E	C	C	C	C	C	C	C	C	C	C
43. Water Viper			E?	N	N		N	P	P	P	P	P	P	E	P
44. Black Viper			E?	N	N				P	P	P	P	P	P	P
45. Brown-Viper			E	N	N				P			P	P	E	E
46. Copper-Belly Snake		C	N	N		E		C	E	E	C	C	C	C	
47. Bluish-green Snake		E	E	E	E	E	E	E		E	E			N	E
48. Black Snake		C	C	C	C	C	C	C	C	C	C	C	C	C	E
49. Little Brown Bead-Snake		E?	N										N	C	
50. Ribbon-Snake		C	C	C		C	C	C	C	C	C	C	C	E	C
51. Spotted Ribbon-Snake		C?	N					P?			E		N	C	
52. Chain-Snake		C	C	C		C	C	C	C	C	C	C	C	C	C
53. Green Spotted Snake		P	P	P		P	P	P	P	P	P	P	P	P	P
54. Coach-Whip Snake		C	N	N		C	E	C	E	E	C	C	C	C	
55. Corn Snake			E?	N	N		N	C	C	E	E	C	C	E	C
56. Hog-nose Snake		E	E	E	E	E	E	E	E	E	E	C	E	E	E
57. Green Snake		C	C	C	C	C	C	C	C	E	E	C	C	C	C
58. Wampum Snake		E?	E	E		E?	E?	E	E	E	E	P		E	P
60. Bead Snake		E?	E	E		E?	E?		E	E	E	C?	P	E	P

Table 4. Comparison of author's notes from Catesby plate 47 compared with Field Guides. 1. Indraneil Das (2012); 2. Merel J. Cox et al (1998); 3. Peter Heimes (2016)

Character	**Pl 47,1st ed.**	**Pl 47, AHE**	***A. mycterizans***	***A. nasuta***	***L. ahaetulla***
Dorsal color	Bluish-green	More blue than green	1. Green, grayish green or brown 2. Green, brown or gray	1. Green or olive brown 2. Tan to grey and yellow	3. Bright green
Ventral color	Leaf-green	Light grayish to blue-green	1. White 2. White	1. Pale green 2. Light green	3. Pale or yellowish green
Ventro- lateral line	Yellowish	White	1. Ends of ventrals white 2. White line	1. Yellowish line 2. Not noted	3. None
Rostrum	Extended & upturned	Extended, rises to level of the supra-oculars	1. Elongated 2. Not noted	1. Long appendage 2. Long, pointed appendage.	3. Not long or pointed

[and] They are all over of a shining black [...] They are very nimble and beneficial in killing rats, which they pursue, with wonderful agility, to the roofs, and all parts of houses and barns, where rats are able to run [...] They are bold and furious, leaping at and biting those that attack them [...] it is commonly said in *Carolina,* that they will attack and swallow Rattle-Snakes [...] They are the most numerous of Snakes."

Catesby (1743) did not mention Virginia in his account, although his note "it is commonly said in *Carolina,*" leaves an impression that they were also known in Virginia, but without the observation that they prey upon Rattle-Snakes. His description seems weighted toward *Coluber constrictor* and his painting is more representative of *Coluber constrictor* than of *Pantherophis quadrivittatus*.

Plate 49, The little brown Bead Snake, *Anguis Minor Fuscus Maculatus* (Fig. 9).
Previous identifications: *Leptodeira annulata, Storeria dekayi.*
Proposed: *Storeria dekayi* (Holbrook, 1839).

This plate was not addressed by Linnaeus (1766), Pennant (1787), Gmelin (1788), Lacépède (1789), Soninni and Latreille (1801), Shaw (1802), Daudin (1803), Harlan (1827), Holbrook (1842), or Duméril, Bibron and Duméril (1854). Forster (1771) and Ewan (1974) listed it with no matching Linnaean binomial. Edwards (1771) cited it under *Coluber annulatus?* (= *Leptodeira annulata*) but expressed doubt. *Leptodeira annulata*, a semi-arboreal snake of Central and South America with a blotched pattern that reaches over three feet in length, matches this snake in no characteristic (Maraj 2017). Reveal, more than two hundred years after Edwards' unsuccessful attempt, identified it as *Storeria dekayi* and was, I suggest, correct.

Catesby (1737) wrote "[they are] always small, seldom appear above Ground [...] All the Back and upper Part of the Body, have *transverse Spots of brown and white*, so disposed, as to make some Resemblance to a string of Beads" [emphasis added]. A description of *Storeria dekayi* by Beane et al. (2010) supports Reveal: "The dorsum of this small serpent is brown, gray, or reddish, usually with a pale median stripe. Small, paired black or dark brown spots usually occur along the margins of the stripe. *The spots of some individuals fuse to form short transverse bars*" [emphasis added]. Such a pattern over a pale median stripe would appear as Catesby's "transverse spots of brown and white."

Plate 50, The Ribbon-Snake, *Anguis Gracilis fuscus* (Fig. 10).
Previous identifications: *Thamnophis saurita, Thamnophis sirtalis*.
Proposed: *Thamnophis saurita* (Linnaeus, 1766).

Pennant (1787) was the only author of fourteen to not address this plate. Linnaeus (1766), Edwards (1771), Forster (1771), Gmelin (1788), Lacépède (1789), Sonnini and Latreille (1801), Shaw (1802),

Daudin (1803), Harlan (1827), Holbrook (1842), Dumeril, Duméril and Duméril (1854), and Reveal (2015) cited it under *Coluber* (= *Thamnophis*) *saurita* (or a synonym). Ewan (1974) selected *Thamnophis s. sirtalis* and referenced Klauber (1948) for his decision. In *Copeia* 1948:1, Klauber, used ventral and sub-caudal scale counts to establish that Linnaeus had named *Coluber sirtalis* in 1758 using a specimen of the snake he would name *Coluber sauritus* in 1766. Pehr Kalm had supplied the *Coluber sirtalis* specimen from Canada, Alexander Garden provided the *Coluber sauritus* specimen from Carolina, and since the latter is the taxon cited by Linnaeus for Catesby 50 and by all other than Ewan, Klauber's 1948 discussion of *sirtalis* vs *sauritus* has no relevance.

Fig. 9. Catesby Plate 49, The little brown Bead-Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Plate 51, The Spotted Ribbon-Snake, *Anguis Gracilis Maculatus* (Fig. 11).
Previous identifications: *Thamnophis sirtalis, Sibon nebulatus, Storeria dekayi***.**
Proposed: *Thamnophis sirtalis* (Linnaeus, 1766).

This plate was not addressed by Linnaeus (1766), Pennant (1787), Gmelin (1788), Lacépède (1789), Soninni and Latreille (1801), Daudin (1802), Harlan (1827) or Duméril, Bibron and Duméril (1854).

Forster (1771) and Ewan (1974) listed it with no matching Linnaean binomial. Edwards (1771) cited it under both *Coluber* (= *Thamnophis*) *sirtalis?* and *Coluber* (= *Sibon*) *nebu-*

Fig. 10. Catesby Plate 50, The Ribbon-Snake (watercolor). Cour tesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 11. Catesby Plate 51, The Spotted Ribbon-Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

latus?, expressing doubt with each. *Sibon nebulatus,* a Central and South American, and Caribbean Snake that, while brown spotted with black, does not have the vertebral stripe described by Catesby (Ward 2016). Shaw (1802) cited this under *Coluber ordinatus* (= *Thamnophis sirtalis*) with doubt, and also cited plate 53 (Green Spotted Snake). Holbrook wrote "I have not been able to identify [it] with certainty with any of our serpents, though it seems most to resemble the *Tropidonotus* (= *Storeria*) *Dekayi*." Catesby (1743) wrote it is "usually about the size of the figure," and that size (estimated 23 inches) does not support *Storeria dekayi*. He was unwilling to declare this distinct from the Green Spotted Snake, though he listed it separately, and at the same time, saw a relationship between this and his Ribbon-Snake (plate 50). Although Edwards and Shaw cited *Coluber ordinatus* (*Thamnophis sirtalis*) with doubt, none until Reveal (2015) did so unequivocally, and, I submit, was correct.

Catesby (1737) described it as "slender [...] the Upper part of it [...] Brown, spotted with Black, the Belly White, on the Ridge of the Back extends a List of White, the whole Length of it" (vertebral stripe). His painting is not definitive, as he depicted it in lateral view with indistinct stripes. However, taken together with the written description and his naming it to be one of two ribbon snakes (which is to say *Thamnophis*), there is none but *Thamnophis sirtalis* that fits.

Plate 52, The Chain-Snake, *Anguis Annulatus* (Fig. 12).
Previous identification: *Lampropeltis getula.*
Proposed: *Lampropeltis getula* (Linnaeus, 1766).

Pennant (1792) was the only author of fourteen to not address this plate. Linnaeus (1766) cited it under *Coluber getulus* (= *Lampropeltis getula*), and the remaining twelve agreed with it (or a synonym).

Plate 53, The Green Spotted Snake, *Anguis Viridis Maculatus* (Fig. 13).
Previous identification: *Thamnophis sirtalis*.
Proposed: *Pantherophis quadrivittatus* (Holbrook, 1842)[1], composite design with *Thamnophis sirtalis* (Linnaeus, 1758).

While Pennant (1787) did not address this plate, Linnaeus (1766), Edwards (1771), Forster (1771), Gmelin (1788), Lacépède (1789), Soninni and Latreille (1801), Daudin (1803),

[1] Recent revisions of *Elaphe obsoleta* by Burbrink (2001) and of the resulting *Pantherophis alleghaniensis* by Burbrink et al. (2021)

Fig. 12. Catesby Plate 52, The Chain-Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 13. Catesby Plate 53, The Green Spotted Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Harlan (1827), Holbrook (1842), Duméril, Bibron and Duméril (1854), Ewan (1974), and Reveal (2015) cited it under *Coluber ordinatus* (= *Thamnophis sirtalis*), or a synonym, and were correct in part. Shaw (1802) cited this plate under *Coluber ordinatus* (*Thamnophis sirtalis*) and included plate 51 (*Thamnophis sirtalis*), but with doubt. Holbrook (1842) questioned not Linnaeus's original identification as *Coluber ordinatus*, but some of Catesby's written account. Having accepted Linnaeus as correct, Holbrook wrote "Catesby says it grows to nearly four times the size of his figure, which would make it a serpent of nearly four feet in length. [and] as usual with most of his snakes, makes it a 'great robber of hen-roosts—sucking eggs,' &c . . ." Holbrook misjudged the length, and was unfortunately dismissive of the latter point as Catesby had said this of only three, not "most" of his snakes. Both Catesby's 1743 description and painting suggest a composite: "These Serpents sometimes grow to four times the bigness of the figure; are said not to be venomous; and are great robbers of hen-roosts, sucking eggs; though their size seldom enables them to devour the fowls. As the change in marks and colour in some Serpents cause confusion in distinguishing them, I would willingly avoid mistakes, by describing the same Snake twice, and multiplying the kinds to more than there are: And I am diffident in determinating, whether this be a different kind from the spotted Ribbon-Snake, *p.* 51, which somewhat resembles it, though of a different colour."

A snake "four times the figure" would not be "nearly four feet" as Holbrook thought, but would be about eight feet long (my estimate), within the maximum of the former *Elaphe obsoleta* complex and well beyond that of *Thamnophis sirtalis* (Ernst and Ernst 2003). His statement that "their size seldom enables them to devour the fowls," implies that some were sufficiently large. The large size, added to the facts that he said it to be green and to prey on chickens and their eggs, indicates the phase of *Pantherophis quadrivittatus* (Burbrink et al 2021) known today as the "greenish rat snake" from the vicinity of Charleston (Conant 1958; Gibbons 2017).

The watercolor shows a snake with a prominent, green, vertebral stripe and with distinct, black spots at the lateral ends of the ventral scales, both indicative of *Thamnophis sirtalis* but not of *Pantherophis quadrivittatus*. However, the vertebral stripe bisects a dark pattern that approximates (albeit indistinctly) the pair of dorsal stripes of *Pantherophis quadrivittatus*. Unfortunately, he depicted neither the dark lateral stripe of *Pantherophis quadrivittatus*, nor the light lateral stripe of *Thamnophis sirtalis.* This composite was hinted at by Shaw in 1802. It seems clear that he examined both the Eastern Garter Snake (*Thamnophis s. sirtalis*) and the much larger "greenish" rat snake (*Pantherophis quadrivittatus*) and considered an ontogenetic link.

Plate 54, The Coach-whip Snake, *Anguis Flagelli Formis* (Fig. 14).

Previous identifications: *Coluber flagellum, Leptophis ahaetulla***.**

Proposed: *Coluber flagellum* Shaw, 1802.

Neither Linnaeus (1766) nor Gmelin (1788) addressed this plate. Forster (1771) and Pennant (1787) listed it with no matching Linnaean binomial. Edwards (1771) was first to cite it as *Coluber flagellum* and was followed by Lacépède (1789), Shaw (1802), Holbrook (1842), Duméril, Bibron, and Duméril (1854), Ewan (1974), and Reveal (2015), some of whom used a synonym. Sonnini and Latreille (1801), Daudin (1803), and Harlan (1827) cited it under *Coluber filiformis* (= *Leptophis ahaetulla*).

Holbrook (1842) wrote that "There is great confusion in the works of European naturalists with regard to this snake." As an example: Daudin (1803) cited it under *Coluber filiformis* (= *Leptophis ahaetulla*) and gave *Coluber flagelliformis* (= *Coluber flagellum*) as a synonym of not this, but of Catesby 57 (= *Opheodrys aestivus*). Further, he cited *Coluber* (= *Opheodrys*) *aestivus* (Catesby 57) under Catesby 47, which is

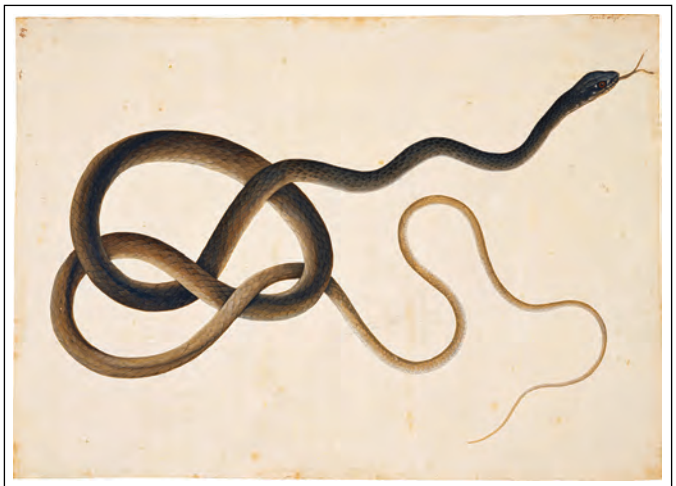

Fig. 14. Catesby Plate 54, The Coach-whip Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 15. Catesby Plate 55, The Corn-Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

proposed herein as *Ahaetulla nasuta*. However, coupled with locality, Catesby's 1743 figure could stand alone for *Coluber flagellum*, as could his description of a "very long slender Snake, particularly the hind Part, it diminishes gradually to the Tail, and from the Resemblance of a Coach-Whip has received its Name [and] The Colour of it is brown, it is very active and nimble, running very swiftly."

Plate 55, The Corn Snake, *Anguis e rubio & albo various* (Fig. 15).

Previous identifications: *Micrurus fulvius, Pantherophis guttatus.*

Proposed: *Pantherophis guttatus* (Linnaeus 1766).

Neither Linnaeus (1766) nor Gmelin (1788) addressed this plate. Forster (1771) and Pennant (1787) listed it with no matching Linnaean binomial. Edwards (1771) and Ewan (1974) cited it under *Coluber* (= *Micrurus*) *fulvius,* but Catesby's plate 55 resembles *Micrurus fulvius* in no characteristic. Lacépède (1789) introduced some confusion by listing Catesby 55 under a snake he named La Tachetee, or the Mottled Viper (Kerr's 1802 translation) with no Linnaean binomial. Daudin (1802) and Harlan (1827) listed it as *Coluber maculatus* and gave Lacépède's La Tachetee as a synonym. Holbrook (1842) cited Catesby 55 under *Coluber* (= *Pantherophis*) *guttatus* with Daudin's *Coluber maculatus* as a synonym, where it remains listed today (Wallach, Williams and Boundy 2014). Confusion enters when it is recognized that the snake presented by Daudin as *Coluber maculatus* was said to have 119 ventral and 70 subcaudal scales, and that Ernst and Ernst (2003) give the ventral scale range of *Pantherophis guttatus* as 201-245. With 119 ventral scales, *Coluber maculatus* could not have been *Pantherophis guttatus.* Sonnini and Latreille (1801), Shaw (1802), Holbrook (1842), Duméril, Bibron and Duméril (1854) and Reveal (2015), correctly cited this under *Pantherophis guttatus* (or a synonym).

Holbrook (1842) wrote that plate 55 "is the Corn-snake, and agrees with the Coluber guttatus in every respect." Catesby's watercolor, arguably his best rendition of color and pattern, clearly represents *Pantherophis guttatus,* and not *Micrurus fulvius*.

Fig. 16. Catesby Plate 56, The Hog-nose Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Plate 56, The Hog-nose Snake, *Anguis Capite Viperino* (Fig. 16).

Previous identifications: *Agkistrodon contortrix, Heterodon platirhinos, Heterodon simus*.

Proposed: *Heterodon simus* (Linnaeus, 1766).

Linnaeus cited Catesby 56 under *Boa contortrix,* which has been considered *Heterodon contortrix* (= *Heterodon platirhinos*) at some times (Stejneger and Barber 1917) and *Agkistrodon contortrix* at others (Klauber 1948; Schmidt 1953). In order to follow the path of plate 56, a brief discussion of *Boa contortrix* is needed. Linnaeus cited Catesby 56 under *Boa contortrix,* describing it as having venom glands but no fangs, and Edwards (1771), Forster (1771), Pennant (1787), Gmelin (1788), Lacépède (1789), Sonnini and Latreille (1801) and Shaw (1802) followed his lead. Linnaeus's de-

scription as having venom glands but no fangs led some reference works of the day to state that "its bite is not reckoned poisonous (Encyclopedia Britannica 1771, 1797). Daudin (1803) cited both *Boa contortrix* and Catesby 56 under *Cenchris mokeson* (= *Agkistrodon contortrix*) establishing both as venomous snakes. Harlan (1827) listed Catesby 56 under *Cenchris mokeson* (thus venomous) with no mention of *Boa contortrix*.

Holbrook (1842) finally separated Linneaus's *Boa contortrix* from Catesby's Hog-nose Snake. He cited the former under *Trigonocephalus* (= *Agkistrodon*) *contortrix* affirming its venomous nature, and then cited the latter under *Coluber* (= *Heterodon*) *simus* and was the only author to do so. He considered it *Heterodon simus* "because the *Heterodon simus* is common in the section of the country visited by Catesby, while the *Heterodon platirhinos* is there seldom, if ever, seen." Whether the latter is or is not the case, Catesby's watercolor depicts, albeit crudely, "the sharply upturned . . snout" of *Heterodon simus* rather than the "only slightly upturned rostrum" of *Heterodon platirhinos* as each is described by Ernst and Ernst (2003). Catesby (1743) also wrote "These snakes [have] the Nose turning up like that of a Hog," a description more apt for *Heterodon simus* than *Heterodon platirhinos*. He noted that, at first, he considered it to be a Viper, but that he searched for and did not find fangs. Duméril, Bibron and Duméril (1854), Ewan (1974) and Reveal (2009) correctly cited plate 56 as a *Heterodon,* but incorrectly as *Heterodon platirhinos*.

Clouding the issue, Edgren (1952) established that Linnaeus described *Coluber simus* from a specimen of *Heterodon platirhinos*. Along with *Boa* (= *Agkistrodon*) *contortrix* these deserve a review of their own that can be set aside for this discussion.

Plate 57, The Green Snake, *Anguis Viridis* (Fig. 17).
Previous identifications: *Opheodrys aestivus, Coluber flagellum, Leptophis ahaetulla, Opheodrys vernalis*.
Proposed: *Opheodrys aestivus* (Linnaeus, 1766)

Linnaeus (1766), Edwards (1771), Forster (1771), Pennant (1787), Gmelin (1788), Lacépède (1789), Soninni and Latreille (1801), Holbrook (1842), Duméril, Bibron and Duméril (1854), and Ewan (1974) all cited this under *Coluber* (= *Opheodrys*) *aestivus* (or a synonym). However, Daudin (1803) and Harlan (1827), continued the confusion within the slender, whip-like snake group, citing it as *Coluber flagelliformis* (= *Coluber flagellum*) and *Coluber filiformis* (= *Leptophis ahaetulla*) respectively.

Whereas *Coluber flagellum* is dismissed by color alone, *Leptophis ahaetulla*, a snake of South America and the Caribbean is arboreal with dorsal and ventral coloration much like *Opheodrys aestivus* (Baboolal 2011) is not so readily cast aside. However, as *Opheodrys aestivus* had been documented in Carolina by Lawson (1709) before Catesby and would be by many after him, parsimony argues for its choice. Furthermore, Catesby repeated Lawson's claim that the people of

Fig. 17. Catesby Plate 57, The Green Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Carolina were sufficiently familiar with this snake that they would place it "in their bosoms." Reveal, in 2009, thought it *Opheodrys vernalis,* but in 2015 reconsidered and identified it as *Opheodrys aestivus*. Along with its arboreal habit, Catesby's depiction of a very long, slender, whip-like tail establishes it as *Opheodrys aestivus*. Moreover, he was not known to have ever been within the known range of *Opheodrys vernalis*.

Plate 58, The Wampum Snake, *Anguis e caeruluo & albo various* (Figs. 18a, 18b, 18c).
Previous identifications: *Nerodia fasciata, Farancia abacura***.**
Proposed: *Drymarchon couperi* (Holbrook, 1842), composite design with *Pantherophis quadrivittatus* (Holbrook, 1836) and/or, *Farancia abacura* (Holbrook, 1836).

Linnaeus (1766) cited this under *Coluber fasciatus?* (= *Nerodia fasciata*) but with doubt. Edwards (1771), Forster (1771), Gmelin (1788), Lacépède (1789), Sonnini and Latreille (1801), Shaw (1802), Daudin (1803), and Harlan (1827) agreed but expressed no doubt. Neither Pennant nor Duméril, Bibron and Duméril addressed it. Holbrook cited it as "probable" under *Helicops abacurus* (= *Farancia abacura*). Ewan (1974) chose *Natrix sipedon fasciata* (= *Nerodia fasciata*), while Reveal (2009) chose *Farancia abacura*.

Fig. 18a. Catesby Plate 58, The Wampum Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

Fig. 18b. Virginia specimen of *Pantherophis alleghaniensis*, photo courtesy of Paul W. Sattler.

Fig. 18c. *Farancia abacura*, Creative Commons by John Sullivan, CC 3.0.

Holbrook (1842) dismissed Linnaeus's uncertain citation because *Nerodia fasciata* has keeled scales, while the Wampum Snake's scales are smooth. That *Nerodia fasciata* is known to reach five feet in length (Ernst and Ernst 2003) is the only characteristic from Catesby's 1743 description that applies:

"This Snake receives its name from the Resemblance it has to Indian Money called Wampum, which is made of Shells cut into regular Pieces, and strung with a Mixture of Blue and White. Some of these Snakes are large, being five Feet in Length; yet there is no harm in their bite; but as all the largest Snakes are voracious, so will they devour what animal they are able to overcome. *The Back of this Serpent was dark Blue, the Belly finely clouded with brighter Blue, the Head small in Proportion to its Body* [emphasis added]. They seem to retain their colour and marks at every change of their Exuviae. They are found in Virginia and Carolina."

Compare Catesby's description to Holbrook's 1842 description of *Coluber* (= *Drymarchon*) *couperi*: "*The superior surface of the animal is of a deep bright bluish-black* [...] *the anterior part of the abdomen of a light bluish slate-colour* [and the] *Head is rather small* [...] *though distinct from the neck*" [emphasis added]. None but *Drymarchon couperi* matches the dorsal and ventral colors of the Wampum Snake. Several more current descriptions also closely match these dorsal and ventral colors (Ditmars 1939; Schmidt and Davis 1941; Cochran and Goin 1970; Ernst and Ernst 2003; Stevenson, Moulis and Hyslop 2008; Krysko, Enge and Moler 2019). Dorsal and ventral colors in Catesby's watercolor match his Wampum Snake description and, to a lesser extent ventrally, Holbrook's for *Drymarchon couperi*.

However, three discordant notes suggest a composite. First, he declared it to be found in Virginia and Carolina, and *Drymarchon couperi* is not known from Virginia. Second, the Latin descriptive-name he used includes the color white—*Anguis e caeruluo & albo various* (blue snake variegated with white)—as does the figure in his watercolor. Third, along the snake's full length, he depicted its ventral color to ascend from the ventro-lateral angle in patches of irregular shape.

To identify other taxa that might have been included, I considered all black snakes of Virginia and the Carolinas known to reach five feet in length (Ernst and Ernst 2003; Gibbons 2017). Two, *Coluber constrictor* and *Lampropeltis getula*, were described elsewhere by Catesby and eliminated, as was *Farancia erytrogramma* due to its pattern of red longitudinal stripes. Only *Farancia abacura* (Fig. 18b) and black phase *Pantherophis quadrivittatus* (Fig 18c) remained.

Regarding *Helicops abacurus* (= *Farancia abacura*), Holbrook (1842) wrote "It seems to me quite probable that this may be the Wampum Snake of Catesby, which I have never been able clearly to identify with any one of our serpents." He described it as "bluish-black" which fits, but added "the flanks are marked with transverse bands of bright red" which does not. Since Catesby neither mentioned nor painted red regarding the Wampum Snake, *Farancia abacura* would also seem to be eliminated.

However, the shape of the ventro-lateral patches drawn by Catesby are reminiscent of the shape of the "transverse bands of bright red" noted by Holbrook as on "the flanks," and this shape alone might have been behind his selection

of *Farancia abacura* as probable. Gibbons (2017) noted that this red is sometimes replaced by white, and Catesby's reference to, and use of, white could have originated from such a variant, or from a specimen preserved in alcohol with the red bleached to white. However, Catesby painted the ventrum as blue rather than white, and at the upper edges of the ventro-lateral patches he painted thin, white, irregular margins (Fig. 18a) which might suffice as the white variegations in his Latin descriptive-name.

Black phase *Pantherophis quadrivittatus* (Burbrink et al. 2021) must also be considered as Catesby would almost certainly have encountered it in Virginia. In the original description of *Coluber alleghaniensis* (= *Pantherophis quadrivittatus* of Burbrink et al. in Virginia), Holbrook (1837) wrote "many of the scales have marginal dashes of white, which become visible when the skin is extended." My experience with this taxon in Pennsylvania and Maryland holds that, apart from the white seen on the extended skin, white or light yellow variegations of variable extent often appear as a remnant of the juvenile pattern.

Catesby would have completed his painting and account of this snake while in Carolina or later, and his Virginia reference would, necessarily, have been from memory. Other than the white margins of the ventro-lateral patches noted above, his watercolor of this snake has a uniformly dark blue dorsum and a lighter-blue ventrum. It is more consistent with *Drymarchon couperi* than with any other snake of Eastern North America. Discordances suggest a composite, with *Pantherophis quadrivittatus* (black phase) and/or *Farancia abacura* providing possible, though not wholly satisfying, choices.

Plate 60, The Bead Snake, *Anguis niger, maculis rubris & luteis eleganter varius* (Fig. 19).

Previous identifications: *Pantherophis guttatus, Cemophora coccinea, Micrurus fulvius***.**

Proposed: *Cemophora coccinea* (Blumenbach, 1788), composite design with *Micrurus fulvius* (Linnaeus, 1766).

Linnaeus (1766), Gmelin (1788), Lacépède (1789), cited this with doubt under *Coluber* (= *Pantherophis*) *guttatus?* and Edwards (1771), Forster (1771), Shaw (1802), Daudin (1803), Harlan (1827), and Ewan agreed, but with no doubt expressed. Neither Pennant nor Soninni and Latreille addressed it. Duméril, Bibron, and Duméril (1854) cited it under *Simotes coccineus* (= *Cemophora coccinea*), Reveal (2015) agreed, and both were correct in part. Holbrook (1842) recognized the two snakes I propose to be a composite in this plate, but attempted to choose between the two, writing: "It is a matter of much doubt which of our reptiles Catesby's Bead Snake was meant to represent. It must, I think, be either the *Coluber coccineus* of Blumenbach, or the *Elaps fulvius*; the disposition of the spots on the back agrees best with the former; yet the colours, red, black and yellow, belong to the latter animal [...] though they are not disposed in rings."

The Latin descriptive-name given by Catesby, *Anguis niger, maculis rubris & luteis eleganter varius*, describes a black snake with red spots and elegant yellow variegations, and matches his written description.

Fig. 19. Catesby Plate 60, The Bead Snake (watercolor). Courtesy Royal Collection Trust / © Her Majesty Queen Elizabeth II 2022.

These snakes are usually about the size of the figure, some less; and some I have seen three or four times as big. The ground Colour of them is black, deeper on the Back and fainter under the Belly: The upper Part of the Body is adorned with large Spots of a bright red Colour, between which, at regular Distances are yellow Spots. [...] They have nothing of a Viper, either in Form or Quality, but are very inoffensive.

His statement that they "are very inoffensive" does not disqualify *Micrurus fulvius,* as Holbrook (1847) wrote of it: "[they] are of very mild character [and] they are universally regarded as innocent snakes, and are constantly handled with impunity . ." The snake Catesby painted has a head shape and color consistent with *Cemophora coccinea*, and has red, ovate, dorsal blotches also matching that snake. However, its black dorsal and ventral ground color, along with yellow lateral blotches, means that he could not have painted it using only *Cemophora coccinea*. Moreover, the shape and color of the head and dorsal blotches means that he could not have painted it using only *Micrurus. fulvius*. His estimate of the length adds to the composite proposal: A snake "the Size of the Figure" would be about twenty-one inches long (my estimate), which could be either *Cemophora coccinea* or *Micrurus fulvius*, and one "three or four times as big" would be sixty-three to eighty-four inches long (my estimate). While the latter is too long for either, he clearly referenced a snake larger than *Cemophora coccinea*. Maximum lengths being 32.6" for *Cemophora coccinea* and 47.8" for *Micrurus fulvius* (Ernst and Ernst 2003).

Although he wrote that he painted reptiles while alive and apparently in captivity, this plate offers the clearest evidence that he completed at least some of his watercolors with no specimen before him. That he did not depict the bold, black, red, and yellow bands of *Micrurus fulvius*, but did depict a black snake with its red dorsal blotches commensurate with *Cemophora coccinea* seems confirmation. This seems anoth-

er case of Catesby considering an ontogenetic relationship between smaller (*Cemophora coccineus*) and larger (*Micrurus fulvius*) snakes of similar appearance. Even modern guides (Ditmars 1915; Camper 2019 and others) discuss their similarity and advise readers how to differentiate the two.

Conclusions

Several observations from Catesby (1743) regarding the rattlesnake suggest he was a careful observer, even ahead of his time: 1) Rattlesnakes "are never the aggressors, except in what they prey upon [...] unless they are disturbed, they will not bite." (Lawson had also noted this in 1709), 2) The number of rattle segments does not equal a rattlesnake's age, 3) Danger from a rattlesnake bite increases with larger snakes and their greater volume of venom, 4) The successes claimed for folk snakebite remedies were the result of bites delivered by small rattlesnakes to "a muscular part" of the body, with the implication that the patient would have survived regardless, and 5) He accurately described the noise generating mechanism of the rattle.

Regarding folklore, he seems not so credulous as some others. He designated as "silly" the notion that the Coachwhip Snake could "separate a man in two parts" with a jerk of its tail, and declared the tail of the Water Viper to be harmless, in contradiction of folklore that claimed it could deliver a blow as deadly as its bite. As to the rattlesnake "charming" its prey, he reserved judgement, and wrote *"as for my own part, I never saw the action"* [emphasis added]. He recognized ontogenesis and wrote "It is while they are young and growing, that some of them are differently marked at the change of their *Exuviae*, which I shall observe [...] *so far as I know"* [emphasis added] (Catesby 1743).

Thus, he relied on personal observation, considered folklore critically, and was sufficiently cautious that he was unwilling to declare some snakes to be of different species if he thought ontogenesis might be in play. Since the early twentieth century many, if not most North American field guides have devoted space in their species accounts regarding similar species that might be confused with a given taxon (Ditmars 1915; Camper 2019 and others), and Catesby had the benefit of no such guidance. We can speculate that the scope of his specimen examination was too limited, but that he didn't recognize it as such. Witness his recognition of only two water snake species when he would certainly have encountered many individuals of several species as Lawson (1709) had before him. It must be remembered that he single-handedly searched out, illustrated, described, and in many cases collected and preserved, over 400 taxa, including plants, invertebrates, fish, amphibians, reptiles, birds, and mammals, and that the time available to consider each was necessarily limited. The aforementioned considerations, coupled with his having few precedents for reference (none with illustrations of the snakes), and having no knowledge that squamation was to become important, rendered the task of snake species recognition more difficult for him than for any who came after. As noted, McBurney (2021) suggested he may have created at least some of his images from "different exemplars" and it is highly likely that some of these, though similar in appearance and habit, were of different species. The several composites proposed herein resulted.

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Abstract. Looting is obviously a general feature of war in all times. This is true not only for a number of cultural and archaeological objects that we still see in museums today, but also for a large number of mostly smaller objects that are often in private hands. Such is the case with the book discussed here: Hermann Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien" (1837–44) was meticulously and precisely copied as part of a 69-volume collection of similar natural history works by Heinrich Rost, the director of an educational institute and an enthusiastic naturalist, and used to organise his extensive collection of natural objects as well as for teaching purposes. After Rost's death, the entire collection was bequeathed to the renowned Lübeck City Library. The collection was stored in mine tunnels during the Second World War and transported with a myriad of other artifacts to Russia in 1946. Here the trace of many volumes is lost, but one copy, on which this article focuses, turned up in the USA at the end of the last century and is now being returned to the Lübeck City Library by its owner.

Zusammenfassung. Plünderungen stellen offenkundig ein generelles Bestandteil von Krieg in allen Zeiten dar. Das gilt nicht nur für eine Vielzahl von kulturellen und archäologischen Gegenständen, die wir noch heute in Museen zu Gesicht bekommen, sondern auch für eine Vielzahl zumeist kleinerer Objekte, die sich oft in privatem Besitz befinden. Das trifft auch auf das hier behandelte Buch zu: Hermann Schlegels "Abbildungen neuer oder unvollständig bekannter Amphibien" (1837–44) wurde im Rahmen einer 69bändigen Sammlung ähnlicher naturkundlicher Werke von Heinrich Rost, dem Leiter eines Erziehungsinstituts und begeisterten Naturforschers, minutiös und ungemein präzise abgemalt und zur Ordnung seiner umfangreichen Sammlung an Naturobjekten wie auch zu Unterrichtszwecken benutzt.

Key words. Heinrich Rost, Hermann Schlegel, Stadtbibliothek Lübeck, looting, restitution of looted cultural items

Introduction

Throughout history, looting has gone hand in hand with war. Sometimes looting has been done by nations, but soldiers and even locals are also guilty of stealing under the cover of war (Lossin 2008). Although there is no moral distinction between the one or other side in the conflict, right up to the present time the winner seems to live in the belief that they can take whatever they want. Art and culture are crucial to a country's identity, and the same is self-evidently true of the loss of important art and cultural assets. If this loss also relates to supporting artifacts of high symbolic significance, devastating damage may have been done to a country's identity. Through the looting of such resources, the identity of a people might even be destroyed *expressis verbis*. This may explain why looted books in large numbers were transported from Germany to Russia: "So gelangten deutsche Bücher, ca. 100.000, nach Tiblissi in Georgien, aber auch in großer Anzahl (Millionengröße) nach Kiew und Minsk" (Fligge and Schweitzer 1997) [Thus, German books, about 100,000, reached Tiblisi in Georgia, but also in large numbers (millions) Kiev and Minsk].

In 2003, the Iraq National Library and Archives were looted by locals as the U.S. military stood by (Lossin 2008). The collections lost in this library included many items of inestimable historical value—Iraq was the centre of knowledge during the Middle Ages. We have Iraqi institutions to thank for the protection and translations of ancient Greek and Roman manuscripts that we value as part of Western Culture today (Lindberg 1978).

It wasn't until the early 20th century that efforts were made to outlaw wartime looting. The Hague Conventions of 1899 and 1907 laid the groundwork for international laws regarding wars and war crimes. However, it wasn't until the 1954 Hague Convention that cultural property was protected—this includes art and archaeological items as well as libraries and manuscripts. Since then, additional international laws, such as the 1970 UNESCO Convention and the 1995 UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects, have supported efforts to return items stolen during war to their original country or owner (German 2020). Because of laws like these, the Museum of the Bible in Washington, D.C. has returned over 8,000 items to Iraq which are thought to

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have been taken from the Iraqi National Library and Archives (Arraf 2020). Since World War II attempts have been made to recover many objects that make up the culture of several countries and are part of their identity.

Extensive looting during World War II may have been what pushed the Hague Convention to specifically protect cultural items. Many of the repatriated items making the news today were originally stolen during this war. It is much more difficult to hide large and valuable items that have been stolen—valuable artwork and archaeological items—particularly if they are housed in museums and presented to the public. Smaller and less valuable items, which certainly make up the vast majority of the stolen items, are more likely to reside in private hands. Once in private hands it becomes quite easy to sell and distribute these items without anyone ever knowing they had been stolen. This is exactly what has happened with a unique, hand-copied facsimile of Hermann Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien" (1837–1844), which was retained in the Lübeck Library until the turmoil after the end of the war clouded its further path. This is the story of this unique volume, its creator, and what we know of its journey from Germany to the USA and back.

Johann Heinrich Nikolaus Rost (7 June 1795–23 July 1855)

Johann Heinrich Nikolaus Rost was born in Uetersen, northwest of Hamburg, where his father was clerk and magistrate of the monastery. From 1816 to 1819 he studied law—first in Göttingen, then in Kiel and finally in Glücksstadt, where he passed his bar exam. After that he returned to Uetersen to help his aging father and substituted for him as monastery clerk and magistrate. After his father's death in 1826 Heinrich studied philology in Kiel until 1828. He worked part-time as a private teacher of ancient and modern languages. In his time as a monasterial official, Rost wrote and revised several publications mostly concerning the Uetersen monastery and several additional articles in diverse journals (Alberti 1867: 483). More in the realm of his natural scientific interests are a monograph about the Greek isle of Rhodos from an archaeological perspective and a work "Ueber die Geschiebe und Versteinerungen Holsteins" (Schröder 1873) [On the boulders and fossils of Holstein]. It is for these works, all published before 1826, that he is arguably best known today. In 1827, in the same year of his bar exam, he founded an educational institute in Kiel where he remained as the head until 1847. Rost developed a keen interest in natural history and began collecting zoological specimens, particularly shells, fossils, and insects. His highly renowned collection of 20,000 specimens required in its great diversity a scientific order that could only be achieved through fundamental works. As was often the case in those times, because of costs or availability, he decided to copy the works he needed.

1847 he moved because of family matters to Hamburg where he founded and owned the Gutta-Percha-factory, producing a caoutchouc-like material (Benecke 1923). Allegedly, he soon turned towards teaching again. Rost died on July 23, 1855, in Hamburg.

Rost's collection

Under "Naturwissenschaftliche Handschriften" [Natural science manuscripts] all of Rost's 69 volumes are listed (see Appendix). Obviously, this handwritten register, compiled by Paul Hagen and edited by Anne Harnisch (2018), dates back to the years after 1937.

Rost's solution for building the reference library he needed to organize his collection was to copy by hand all illustrations of 69 important volumes which corresponded closely to the items in his collection. The term "facsimile" in the title of this article generally suggests an exact replica as a photographic reproduction. In this case, though, the literal sense of the word is meant: fac-simile etymologically means "to make similar". And this is exactly what Rost obviously had in mind; he produced a parallel version matching the original as precisely as possible.

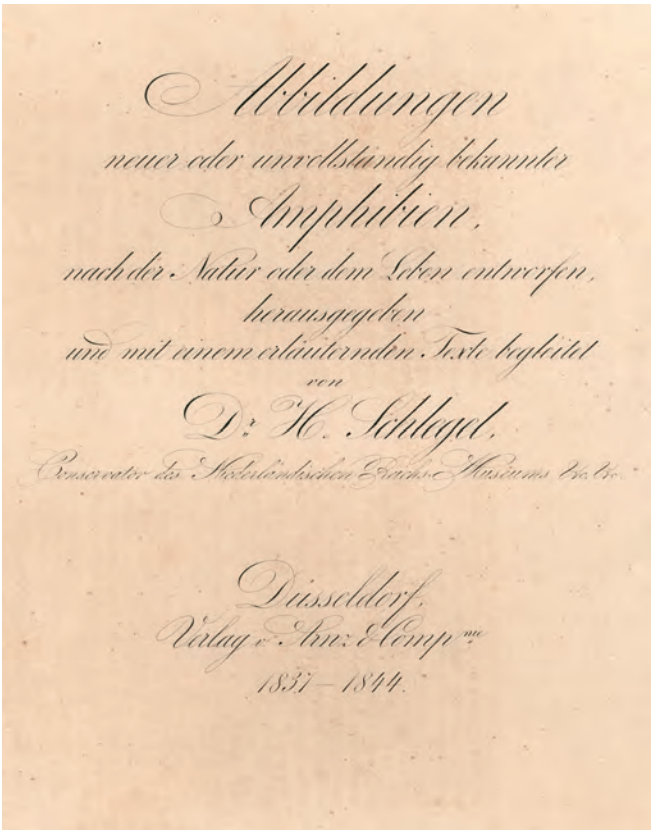
With particular attention to atlases, these carefully drawn and coloured facsimiles were praised as eliciting an even "unmittelbarere, lebensvollere, lebendigere Vorstellung" [more immediate, more vivid, more living conception] than the originals (Lübeckische Blätter 1937 (79): 662). The accompanying texts he abbreviated drastically so that they merely indicated the most important information. The illustrations were at the centre of his interest.

It is no longer possible to definitively determine when he began this work. However, it would be plausible to associate the beginning with the increased focus of his interest in natural science after 1827.

Rost's collection covers a broad field of natural history from osteology of animals (R. 3), crustaceans (R. 4-5), mammals (R. 8-9), ornithology (R. 10-17), reptiles (R. 18-23), insects (R. 24-37), conchology and molluscs (R. 42-54), geological works (R. 63-65) to palaeontology, prehistoric plant animals (R. 67-68) and finally beetles again (R. 69). A clear structure or pattern does not seem to underlie the numbering.

This smorgasbord includes a whole series of "Auszüge aus grossen Werken und Abhandlungen" [excerpts from major works and treatises], but also important works such as Eduard Rüppell's "Atlas zu der Reise im nördlichen Afrika" and "Neue Wirbelthiere zur Fauna von Abyssinien gehörig", Maximilian, Prinz von Wied Neuwied's "Abbildungen zur Naturgeschichte Brasiliens" (R. 1), Lamarck's "Histoire naturelle" (R. 7, 46), but also Merrem's "Beiträge zur Geschichte der Amphibien" (R. 22) and of course Hermann Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien" (R. 21), to name but a few from the field of herpetology (see Appendix).

Quite a number of the volumes bear the handwritten note "aus DDR zurück" [back from GDR, East Germany] in the catalogue of the City Library (https://digital-stadtbibliothek.



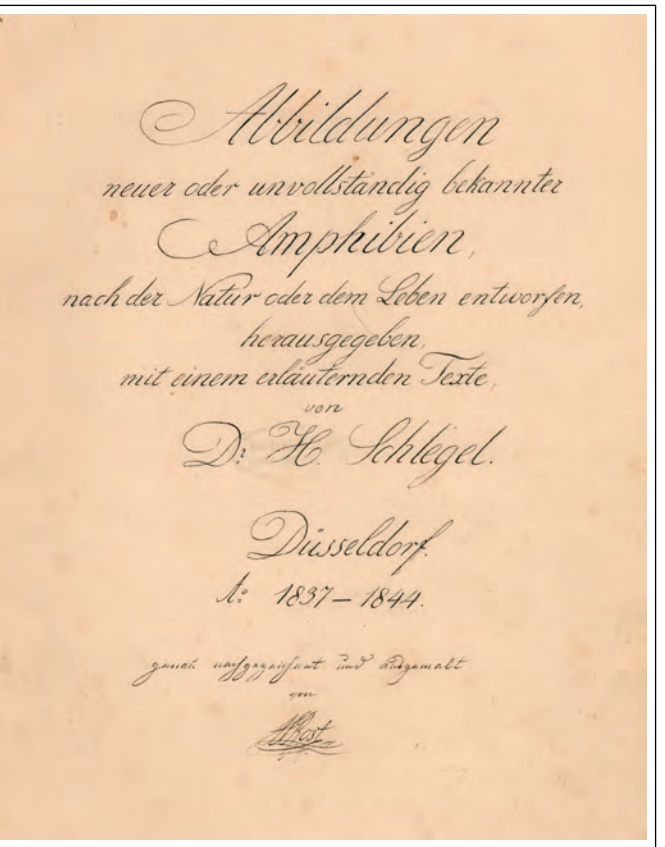


Fig. 1a (left). Hermann Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien: nach der Natur oder dem Leben entworfen" herausgegeben und mit einem erläuternden Texte begleitet von Dr. H. Schlegel, Conservator des Niederländischen Reichs-Museums etc. Düsseldorf, im Verlage von Arnz & Comp. 1837–1844. What looks like handwritten calligraphy at first glance turns out, on closer inspection, to be letterpress typeface in scriptform.

Fig. 1b (right). Titlepage of Rost's edition, which is identical with Schlegel's original, even when Rost leaves out the conjunction "und" [and] after "herausgegeben" [edited] and Schlegel's function in the "Reichs-Museum" in Leiden. Obviously, questions like these were not treated too meticulously at the time. Schlegel himself deviates slightly from his original phrasing only two pages further. But it must have seemed important to Rost to evoke as authentic an impression as possible. This is precisely why he leans on the design of the title page of the atlas volume, right down to the extremely meticulous imitation of the script. Rost's handwritten addition at the bottom of the title page "genau nachgezeichnet und ausgemalt von H. Rost" [accurately traced and coloured by H. Rost] rather makes the impression that he not only wanted to identify his "version" with it, but also to legitimise it, for of course he omitted the obligatory mention of the original publishing place and the name of the publisher "Düsseldorf, im Verlage Arnz & Comp. 1837–1844".

luebeck.de/viewer/image/1447231461037/9/), others "aus SU zurück" [back from SU, Soviet Union] or "zurück aus UdSSR" [back from UdSSR, Union of Soviet Socialist Republics] and in some cases "zurück aus Armenien" [back from Armenia]. More will be said about this aspect at the end of the next section.

The history of the original book: Hermann Schlegel's "Abbildungen"

Not only in the context of the history of herpetological science, but also with regard to general culture and book history, the extraordinary path of a specimen from the 69-volume collection of Heinrich Rost's (1795–1855) library of natural scientific works will be traced here: Hermann Schlegel's (1804–1884) "Abbildungen neuer oder unvollständig bekannter Amphibien, nach der Natur oder dem Leben entworfen" [Illustrations of new or incompletely known amphibians, drawn after nature or life] (1837–1844). It was published almost at the same time as C. J. Temminck's three-volume "Verhandelingen" (1839–1844), which was intended as a statement of accounts on the entire East India expeditions, in which Schlegel himself played a leading role after he became Temminck's assistant in 1825. Schlegel also presented—now in German—a work that primarily aimed to introduce the animal species discovered on those expeditions to the public, but nevertheless presented them in a taxonomically comprehensive broader context. The importance of this work, which is also outstanding in terms of reception, can hardly be overestimated. It was this importance that led Rost to include it in his 69-volume library, probably with the dual purpose of organising his collection but also to use it in his teaching. It is a stroke of luck if today we can contribute illuminating information to the history of this unique work.

Severe air raids of the Royal Air Force in Lübeck in 1942 made it unavoidable to decide how to protect artifacts of outstanding importance. Many volumes of the Lübeck Municipal Library were initially stored in mine tunnels during the turmoil of the Second World War in order to save them from destruction and were nevertheless transported to the then Soviet Union and Armenia after the end of the war together with other war booty. The volume that is the focus of attention here may have had the same fate. At least it is certain that the unique handmade copy, most probably created between the date of publication of Schlegel's original in 1844 and before Rost's move from Kiel to Hamburg in 1847, turned up at the end of the 20th century in the United States. At that time it was Adrian Crane, a collector of herpetological literature, who acquired it in the USA. In 2006, Adrian Crane's library was sold by Breck Bartholomew who published an extraordinary and exceptionally informative catalogue (Bartholomew 2007: 14, AV23) in which this "Unique hand-drawn copy" is presented. In noticing the copy's remarkable quality, but unable to determine its origin, Breck Bartholomew decided to purchase the copy; where it has remained until now.

Once the origin of the facsimile and its history were determined, Breck Bartholomew resolved to return the volume to its original owner, the Lübeck Municipal Library (see *Repatriation from the USA*), to which Rost had bequeathed his collection.

Four-colour printing or technical aspects of publication

Many modern readers of historical works are undoubtedly unaware of the production history of books in the mid-19th century. For taxonomic publications in particular, the colouration of a taxon, in addition to pattern and other details, was of no small importance, when it was necessary to distinguish species from each other. In publication, accuracy was imperative in order to communicate distinguishing characteristics as precisely as possible not only in words but in descriptive pictures as well. It was here, however, that the industrial production of books found its limits, which were only overcome in the 20th century with the invention of four-colour printing. Apart from early, rather cost-intensive processes such as intaglio printing (mezzotinto, Schabkunst), which were mainly used in art production, the publisher of the time had no choice but to have two-colour black and white prints hand coloured by colourists. Although care was taken to ensure that the colours matched correctly, comparisons show that there were always, if only minor, colour deviations (Jacobs 2021: 7), although the draughtspersons in charge were absolute specialists. In this sense, each book with coloured illustrations was unique.

Illustrations of natural history were considered as the most difficult and challenging genre. Specialized publishing houses tended to establish colouring institutes of their own in which work-sharing methods were used so that every labourer generally applied only one colour or at the most two (Hanebutt-Benz and Wilkes 2019: 257). In spite of the demanding task mostly women and even children, who were supposed to be older than 14 years, were used for this task, sometimes on a day wage or piece wage basis. Payment was abysmal, generally "deutlich im unteren Bereich" [clearly in the lower range] (ibid. 267).

The publishing house that issued Schlegel's "Abbildungen" (1837–44), Arnz and Comp., had founded a lithographic institute in 1816 in Düsseldorf and later on in Leiden which, after 1840 took over a large part of the natural history publications. The Amsterdam branch of Arnz and Comp. specialized in colouring (Jacobs and Koch 2021: 71/72). For smaller and medium editions especially, manual colouring was far from obsolete and remained a relatively effective and inexpensive method until the end of the 19th century (Hanebutt-Benz and Wilkes 2019: 252).

Schlegel's "Abbildungen" were printed between 1837 and 1844, but initially pre-published in so-called decades, as was quite often the practice with similar works. The term refers to the fact that each decade consisted of 10 plates with the accompanying text. The reasons for such a publication procedure may be manifold. In the case of Schlegel's Düsseldorf publisher Arnz & Co. it can be assumed that financial difficulties that not only extended the printing run to ultimately seven years, but also reduced the originally planned number of 10 parts at intervals of three months to half, as the "Prospectus" (dated January 1837) advertised, at least contributed to this decision. The subscription price mentioned is "3 Thaler Preussisch Courant" (Schlegel 1837: IV), which would—according to the Deutsche Bundesbank—correspond to about 100 to 120 € ($107–$128; March 12, 2023) today (https://www.bundesbank.de/resource/blob/615162/13c8ab8e09d802ffcf2e5a8ae509829c/mL/kaufkraftaequivalente-historischer-betraege-in-deutschen-waehrungen-data.pdf). The purchasing power of the Prussian Thaler fluctuated in the publishing time of Schlegel's book (1837–44) between 33 and 44 € ($35–$39; March 12, 2023) per Thaler.

Gersdorf mentioned in the review of the second decade that "Der Preis ist nach Verhältniss billig" [the price is relatively cheap] (Leipziger Repertorium 1840: 54), which is a rather surprising statement, even if it—most probably—refers to the black-and-white (uncoloured) version. Generally, the coloured version was twice as expensive as the black-and-white (Hanebutt-Benz and Wilkes 2019: 254).

Whether—as we can assume—the price mentioned in the Prospectus refers only to the black-and-white print and coloured editions were sold at a higher price, books were not cheap in relation to the typical income. This led—as we know, for example, from the Dutch Natuurkundige Commissie—to scientists sitting down in preparation for expeditions and copying and colouring important works themselves, including their illustrations (Jacobs and Shea 2022: 52). Rost's "version" of the "Abbildungen" must also be considered a "private" edition of this kind.

Comparison of Rost's copy with the original

Rost's private edition was undoubtedly not created with the preparation of an expedition in mind as in the case of the members of the Dutch Natuurkundige Commissie, but his motivation must have been of a very similar nature. We know that in 1827 he founded a "Pensions- und Unterrichtsanstalt" [pension and teaching institution] in Kiel, for which he in "1841 um Konzessionierung beim Stadtkonsistorium nachsuchte" [applied for a concession from the city council in 1841] (Lübeckische Blätter, 1937 (79): 661). Studies in natural history were obviously his passion. With these aspects in mind, one may assume that beside organisational questions concerning his collection he also used his private editions as teaching material.

Kiel in the North of Germany had significantly less than 50,000 inhabitants around the middle of the 19th century. We may assume that in a smaller town like this, people with extraordinary interests had knowledge of each other. So, it is rather likely, that Rost knew the Boie family. In view of their common interests, one may assume that Rost's highly praised collection of 20,000 individual natural science items (Lübeckische Blätter 1937 (79): 661) ensured that people with similar interests knew him. This at least is most probably true of Heinrich Boie's elder brother Friedrich, for Heinrich himself had already left Kiel and taken up a post at the Rijksmuseum in Leiden in 1821. In December 1825 he set off with the second expedition of the Natuurkundige Commissie to Java, where he died in September 1827. Friedrich Boie not only took care of his brother's estate, but also published descriptions of his brother's amphibian and reptile species from Heinrich's letters (Boie 1827).

The quality of Rost's reproductions of scientific books were publicly praised, as mentioned above. They were praised for giving a more immediate, vivid, and lively conception of the depicted objects (Lübeckische Blätter 1937 (79): 662) than even the originals. This differs decisively from Schlegel's criticism that most illustrations in natural history works had at best mediocre quality. The majority even contain "Abbildungen, welche ganz nach Willkühr colorirt sind" [illustrations that are coloured entirely at will]. However, the illustrations of his own work, which was in the process of being written, he praised as "getreue und nach dem Leben gemachte Abbildungen" [faithful and true to life illustrations], which—as he repeats—"nach der Natur gemacht, und grösstentheils nach lebenden Exemplaren colorirt sind" [are made according to nature, and mostly coloured according to living specimens] (Abbildungen 1837: III). However, he does not mention the names of the artists—probably primarily Pieter van Oort.

While the book edition of Schlegel's "Abbildungen" was published in two volumes, text and atlas, the individual decades contained the plates of the species depicted together with the accompanying texts which certainly made it easier to compare the illustrations with the corresponding description.

A comparison of Schlegel's original plates and Rost's exact copies initially reveals an astonishing correspondence, right down to details that seem insignificant at first glance. Not only is the overall structure of the depicted specimens completely retained, but even small segments in the depiction of the scales, for example in the studies of specific body parts, have been precisely adopted. The degree of this precision raises the question of the process: It is hard to imagine, for example, that the contours of the animals could be replicated so perfectly if they were repainted by hand even of specialists. It is well known that engravers, for example, placed original drawings directly on the stone or copper plate, which resulted in a lateral inversion in the print (see Fig. 3). This process made it much easier to reproduce the one-to-one transfer, but surprisingly it was not used by Rost.

There are only few changes to the respective plates to note, none of which are of a significant nature (see Figs. 2, 3, 4). The different paper format obviously required a different arrangement of the individual illustrations on the page, even though the numbering was meticulously retained. An extension of the paper can be seen on the left margin of each page most likely added by the binder. Equally insignificant for the recognition of the respective species is the omission of individual backgrounds such as a stone on which *Ceratophrys cornuta* and *C. turpicola* as well as others were placed (Schlegel 1837–44, Atlas volume: Tab. 10; Fig. 2a).

The same applies to the shadow cast under the belly of the individual animal, which Rost obviously did not consider worth retaining—for example, in the case of *Scincus muelleri* (Fig. 3; see also Jacobs and Shea 2022: 55).

In summary, it should be noted that the precision and the degree of agreement are astounding. Minimal differences in the reproduction of the often tiny scales as well as the smallest elements of the drawing cannot be prevented, but are in no way taxonomically significant.

A glance at the size of the volume shows how much precedence the illustrations have over the text: Schlegel's text of 141 printed pages is condensed in Rost's work to just five and a half pages, even including Schlegel's captions (see Fig. 5). Rost's aim was not to produce a copy of Schlegel's "Abbildungen"; his goal is achieved if he can illustrate the unknown world of many newly discovered species. That is why he limits himself to the most central aspects; he does not add his own insights or views, he stays entirely with Schlegel's text. Ultimately, Rost's text consists of merely slightly enriched captions the sole purpose of which is to identify the painting.

Apart from the meticulousness, one can hardly fail to appreciate Rost's incredible diligence. The 50 plates of this work alone and the many additional individual studies must have required hundreds of hours of precise work. In relation to the entire series of 69 volumes of his natural science collection, this shows a man of enormous discipline.

Presumably in 1881, more than twenty years after his death in 1855, Rost's natural history library was bequeathed to the Lübeck Municipal Library, with the annual report stating the

Fig. 2a (left). *Ceratophrys*. Schlegel's original "Abbildungen" (Tab. 10): 1.–2. *C. cornuta*. 3. *C. montana*. 4. *C. turpicola*. The duller colours are probably due to the quality of the photo.

Fig. 2b (right). *Ceratophrys*. Rost's redrawing, Taf. 10. Again we see the extended piece of paper on the left and the changed arrangement of the depicted specimens, although their numbering and even their approximate size was maintained. With the exception of the neglected surface on which the animal is sitting, as well as the only hinted at shadows, even details are rendered very precisely as in the original.

purchase price of "300 Mk. [Mark]" (Lübeckische Blätter. 1937 (79): 662) which would be a bit more than 2,400 € equivalent today (https://www.bundesbank.de/resource/blob/615162/13c8ab8e09d802ffcf2e5a8ae509829c/mL/kaufkraftaequivalente-historischer-betraege-in-deutschen-waehrungen-data.pdf) – about $2,290 (March 6, 2023). The verso page bears the library's stamp (Fig. 6), which is still clearly legible today.

The Lübeck Municipal Library in the Second World War

The Lübeck Municipal Library, today's official name Bibliothek der Hansestadt Lübeck [Library of the Hanseatic City of Lübeck], was founded in 1622, so it looks back on a 400-year history and already had an excellent reputation in the 19th century.

The City Library was formed by the amalgamation of several smaller libraries. Initially, the collections were scattered about the city, the Council Library and the libraries of the churches and former monasteries, were centralised on the upper floor of St. Catherine's Monastery. In addition to private donations, for instance 6.000 volumes of the cathedral provost Johann Carl Heinrich Dreyer (1723–1802) and before this, the collection of the cantor and genealogist Johann Hermann Schnobel (1727–1802), works published in Lübeck were required to be deposited in the library. The inclusion of the Cathedral Library with 130 manuscripts and 500 prints and the incorporation of the library of the St. Michael's Convent of the Sisters of the Common Life (Beguines) with its unique treasure of Middle Low German manuscripts from the 15th century, were important additions to the City Library (Stolterfoht, 1929).

Supposedly, Rost's works were handed over to the Municipal Library in 1881 by the Lübeck Museum of Natural History which most probably had received them after Rost's death in 1855. At first glance it is surprising that Rost did not hand over his collection to the museum in the town he lived in most of his life. The reasons are unknown. Possibly it was a decision of his heirs, possibly the reputation of the museum in Kiel was lower in those days.

Fig. 3. *Scincus typhlocephalus* Müll, in the middle under the body with the additional information "N. Guin. [New Guinea] "Lobo"" (Gassó et al. 2020: NNM001000613). On the right side the name still valid today was added: *Scincus mulleri* Schl[egel]. The online-archive claims that the author is unknown, but we learn from Schlegel that Pieter van Oort drew it "nach dem Leben" (Schlegel 1837: 15; true to life); it is also listed in van Oort's "Lijst der teekeningen" (NNM001001115_002; List of drawings; see Jacobs 2022: 55). In the later print, the image appears laterally reversed because it was copied directly onto the stone.

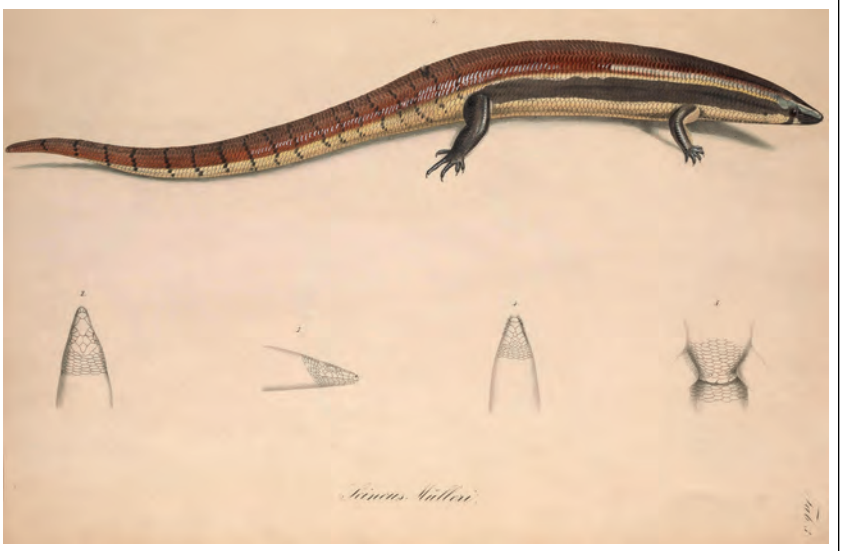


Fig. 3a. *Scincus Mülleri*. Schlegel's Tab. 3 in his "Abbildungen". All drawings used by Schlegel in his "Abbildungen" appear reversed in comparison with the original. In some cases— as here—Schlegel accompanied the depiction of the whole body with some additional studies, drawn by a later artist (Jacobs and Koch 2021: 54/55). The "Abbildungen", as was not uncommon in these times were published in "decades" as the sequentially issues parts of books were called, each of which contained ten plates with the corresponding texts, between 1837 and 1844 (Jacobs and Koch 2021:70–72). This picture was published in the first decade (Tab. 3, 1837). Almost certainly, the illustrations were printed first and then added to the individual decades as needed.

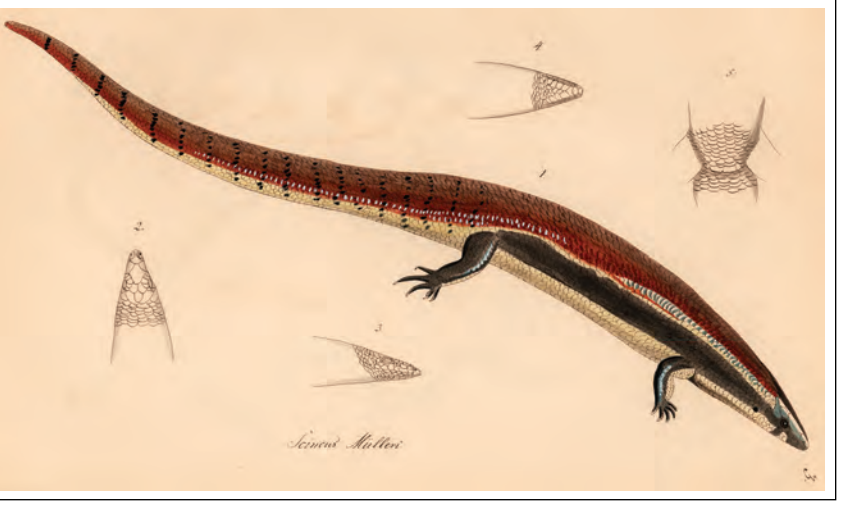


Fig. 3b. *Scincus Mülleri*. In his text Rost records: "Von Müller auf Neuguinea gefunden" and "nach dem Leben gezeichnet" [Found by Müller on New Guinea; drawn true to life] which reflects exactly Schlegel's wording, who acknowledged that the painter, Pieter van Oort, drew it "nach dem Leben" (Schlegel 1837: 15). Rost's reproduction again impresses with its accuracy in comparison with Schlegel's original (Fig. 3a). Even a considerable magnification does not reveal any faults.

The former "Naturalien-Cabinet" was installed in the meeting house of the "Gesellschaft zur Beförderung gemeinnütziger Tätigkeit" [Society for the Promotion of Charitable Activities] at Breite Straße 33 and moved 10 years later to Breite Straße 16. Evidently, it was situated in a prime location in the center of the city. Breite Straße (Fig. 7) became world famous not least because of Thomas (1875–1955) and Heinrich Mann (1871–1950), both of whom were born in Lübeck. The Mann family's home, which burnt down in 1942, was in the immediate vicinity of the museum (after 1869 in Breite Straße 54, and after 1872 in 38). The Buddenbrockhaus can still be found today in a side street.

The library's collections were well known beyond the country's borders because of the large number of manuscripts, incunabula, and rare books.

The seizure of power by the National Socialists marked an end in the development of the library; as in many places, the management of the library was replaced and writings with "dangerous" content were weeded out.

However, the year 1942 witnessed the air raid by the British Air Force, which went down in the history of the city as

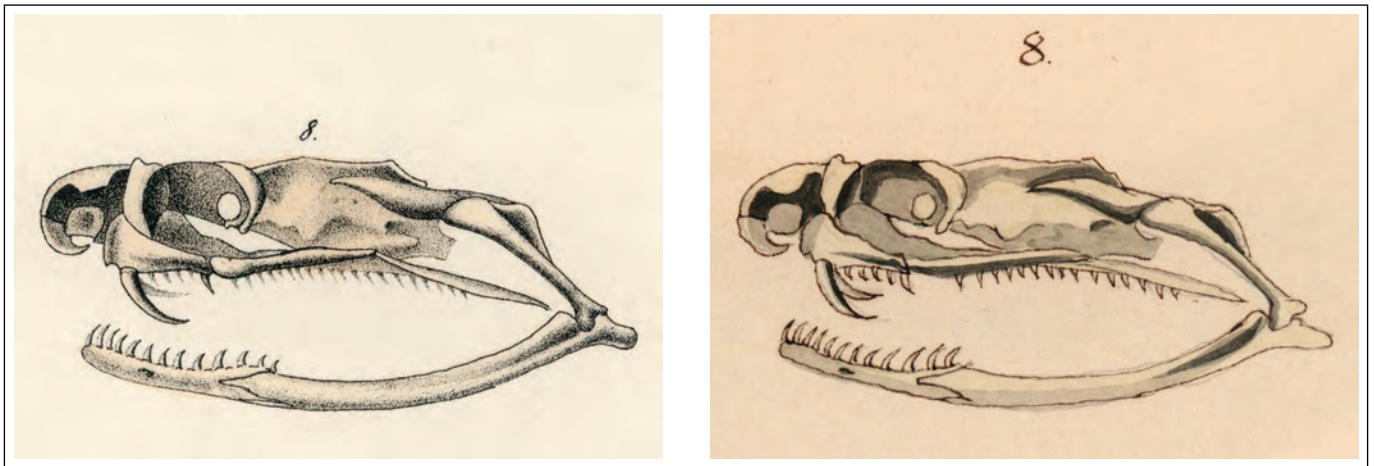


Fig. 4a and b. *Naja tripudians var. sondaica*. In the text volume of his "Abbildungen" Schlegel only explains that figure 8 (Fig. 4a, left) shows the skull from the side. A detailed description can be found in the article co-authored with Salomon Müller, "Over de brilslangen van de indischen archipel" [On the spectacled snakes of the Indian archipelago] (Temminck 1839–47: 70/71), in which he refers to Reinwardt as the name giver. Finally, in his "Essai", he refers to Blasius Merrem as the one who "a donné à ce Naja l'épithète de tripudians, à cause des jeux qu'on lui fait exécuter" [gave this Naja the epithet of tripudians, because of the acts it is made to perform] (1837: 466-471). "tripudians" in Latin means to dance the war dance. Friedrich Boie mentioned the name in 1820 (Boie 1827: 557) referring back to a plate in Russell's "An account of Indian serpents, collected on the coast of Coromandel" (Russell 1796). Rost's version (Fig. 4b, right) is rendered quite meticulously in the main aspects. Rather insignificant details which do not match refer for instance to the number of teeth depicted: in the upper jaw behind the fangs 5 teeth, of which the last one is a bit bigger; after a small gap, 15 more teeth follow instead of 20 in Schlegel's picture. In the lower jaw 12 teeth are depicted, one less than in Schlegel's original.

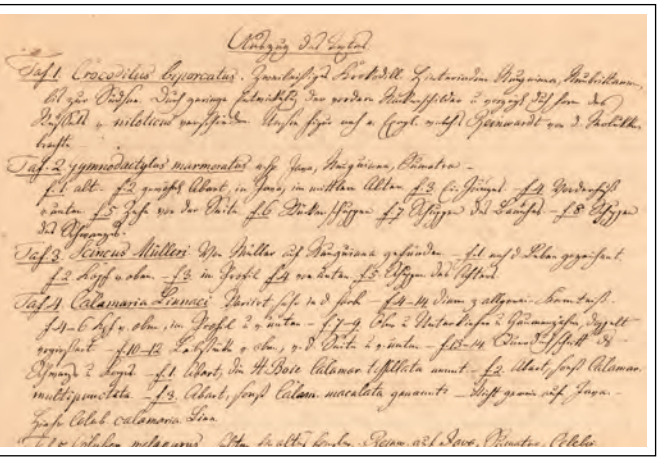


Fig. 5. Beginning of the text part. The text following "Taf.3." belongs to the picture reproduced above (Fig. 3b): "*Scincus Mülleri*. Von Müller auf Neuguinea gefunden. — f.1. nach d. Leben gezeichnet. f.2. Kopf v. oben. — f.3. im Profil f.4. von unten. f.5. Schuppen des Afters" [Tab. 3. *Scincus Mülleri*. Found by Müller on New Guinea. — f.1. drawn true to life. f.2. head from above. — f.3. in profile f.4. from below. f.5. scales of the anus]. The brevity of the notes clearly shows that visual representation was Rost's unconditional priority.

Palmarum 1942, since the bombing, which was aimed at nothing less but the destruction of the city and the demoralisation of the population, took place on Palm Sunday. As a result of this attack, invaluable treasures in the historic churches and the old town hall—some from the 14th century—were destroyed. The City Library itself was not hit by bombs, although it was endangered by the blaze in the neighbouring Katharineum, a kind of secondary school at the time (Schweitzer 1992: 81) just about 100 meters from the library. Nevertheless, many items were lost, as they had been temporarily stored in other buildings with the best of intentions. In order to safeguard what was not burned in this one night of 1942 the most valuable holdings of the city library were removed to mining tunnels near Bernburg (Salle) and Preußlitz (Salzlandkreis), both about 150 km southwest of Berlin and roughly 300 km south of Lübeck. Among the 28,000 volumes stored in 284 boxes were "alle Handschriften, die Inkunabeln, die niederdeutschen Drucke, die Lübecksammlung (Lubecensien) und wertvolle Stücke aus allen Fachgebieten, dabei eine ganze Reihe von Unikaten" [all the manuscripts, the incunabula, the Low German prints, the Lübeck collection (Lubecensia) and valuable pieces from all subject areas, including a whole series of unique items"] (Fligge und Schweitzer 1997).

Lübeck itself had been taken by the British almost without resistance on 2 May 1945. Perhaps the library holdings would have been safer in the city which subsequently belonged to the British occupation zone. As it were, the stored boxes from the distant mine tunnels in the Soviet occupation zone were removed by the Russian occupiers as early as January 1946.

According to a hitherto unpublished letter dated 17 January 1946, the day before "ein rund 100 Mann starkes Kommando unter Aufsicht eines russischen Hauptmanns begonnen, die

Fig. 6. Stamp of the Municipal Library of Lübeck on the verso page of vol. 21 of Rost's library: Luebeckische Stadt-Bibliothek. The name today is Bibliothek der Hansestadt Lübeck [Library of the Hanseatic City of Lübeck].

Fig. 7. August Diedrich Stubbendorf (Ölgemälde): Breite Straße mit Blick auf die Jakobikirche, 1880 [Oil painting by A. D. Stubbendorf: Breite Straße with view of St. Jacobi Church].

von Ihnen eingelagerten Archivalien aus dem Schacht zu nehmen" [a commando of about 100 men under the command of a Russian captain began to remove the archives stored by you from the shaft] (Kaliwerke Bernburg, 17.01.1946). The same was confirmed a few days later by Wintershall AG Bernburg (25 January 1946). From Lübeck alone were "am Ende 284 Kisten" [in the end 284 boxes] in the shaft of Plömnitz (Schweitzer 1992: 83). On January 16, 1946 in Plömnitz and on January 25 in Bernburg the inventories were taken out of the pit and "oberirdisch zwischengelagert" [stored temporarily above ground] (ibid. 86).

The scope of this robbery of cultural property is unbelievable: Russian returnees reported that in Brest-Litovsk "sie im Herbst 1946 einen aus 50 Güterwagen bestehenden Güterzug umgeladen haben, der in Tausenden von Kisten diese Schätze des Archivs und der Bibliothek von Lübeck und anderer Städte enthielt (…)" [they reloaded in autumn 1946 a freight train consisting of 50 freight wagons, which contained in thousands of boxes of these treasures of the archives and library of Lübeck and other cities] (Lübecker Nachrichten, Jg. 3, Nr. 85, 15. Juli 1948).

Via Berlin, these boxes were transported first to Moscow and Leningrad before being distributed to other Soviet republics in addition to the two metropolises. Presumably in a rather arbitrary manner, Kiev and Minsk, but also Georgia's capital Tbilisi, received thousands of German books.

Repatriation from the USA

For many years, there has been a growing awareness worldwide that stolen and looted goods must be returned to their rightful owners; this was first laid down internationally in the Hague Convention of 1907. The Benin bronzes are emblematic of this. However, human remains from mostly colonial contexts should also be returned from ethnological museums to the nations of origin, as determined by a resolution in Germany in 2019 (German 2022, 26 October 2022).

Only a small proportion of the books from German libraries scattered in Russia, Georgia, Azerbaijan and other former Soviet republics have been returned to their places of origin. Many have been destroyed or have simply disappeared. And this is true for other Lübeck collections as well: of the coin collection "tauchten bald die ersten Stücke auf dem Berliner Antiquitätenmarkt auf" [the first pieces soon appeared on the Berlin antiques market] (Schweitzer 1992: 88). Apart from that, the prospects of restoring the archives were quite slim.

Of the "1.350 zurückgekehrten Bänden" [1,350 returned volumes] that were brought back over time, some were "in einem beklagenswerten Zustand" [in a deplorable condition] (Fligge and Schweitzer 1997) due to improper handling and storage and had to be restored at great expense.

In the wake of the fall of the Berlin Wall and the rapprochement of East and West, a partial repatriation from Russia was achieved. Early in September 1991 some pieces were handed over to the Stadtbibliothek (Schweitzer 1992: 97).

This should not obscure the fact that large parts of the library holdings looted at the time must be considered as lost. This is the case for about 1,200 manuscripts, nearly all of the 1,300 incunabula, the Low German printed works from all fields of knowledge, and the collection of printed Lubecensia (Schweitzer 1992: 103/104).

However, in addition to the works returned from Russia and the former Soviet republics, works from the Lübeck collection have also turned up in the United States "so z.B. einige Inkunabeln in Pennsylvania" [such as some incunabula in Pennsylvania]. This makes it "wahrscheinlich, dass auch amerikanische Soldaten Bücher aus Deutschland in die USA mitgenommen haben" [likely that American soldiers also took books from Germany to the USA] (Buske, pers. comm. 19 July 2022).

Of the volumes from Rost's natural history library that were removed in 1942, "insgesamt 18 Bände aus Armenien zurückgekehrt" [a total of 18 volumes returned from Armenia] (Buske, pers. comm., 19 July 2022).

The fact that a further volume of one of the central herpetological works has now appeared in the USA must be regarded as an extraordinary stroke of luck. In the course of research on Salomon Müller, the author of this article contacted the editor of "*Bibliotheca Herpetologica*", who initially sent him Fig. 3 reproduced here. However, it soon turned out that the source was a unique specimen that the editor himself had acquired from another collector of herpetological rarities in 2006. Unfortunately, the further path of the work back cannot be traced.

As the contexts surrounding the origin of the volume became increasingly clear, the owner did not hesitate to offer to return the volume to the Lübeck Municipal Library as a matter of course. Unfortunately, this attitude is not the norm: Still today 50 of the 69 volumes of Rost's library are missing. The same must be said of the library's looted holdings: Until September 1991 only about 45% of the manuscripts that were removed from storage had been returned (Schweitzer 1992: 73).

In May 2023, in conjunction with the publication of this article, the Heinrich Rost copy of Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien, nach der Natur oder dem Leben entworfen" will be handed over to the director of the Lübeck City Library where it will join 18 other facsimiles created by Rost that have been repatriated. It is hoped that this history of Heinrich Rost, his remarkable hand-copied facsimiles, and the Lübeck City Library will raise awareness on what humanity has lost through wartime looting. Just consider the importance of the Lübeck City Library's 28,000 volume collection of manuscripts, incunabula, and rare books to history, not only of the Lübeck Region, but to Europe and the world at large. Today, only about 7,000 of the volumes have been returned to the library, leaving 21,000 volumes lost. Even if all of the missing books are still extant, the collection has been broken up and is no longer available for public access and study. By returning the Rost volume, this book will become available for wider access and study for the first time in 80 years.

Smaller items, such as books, that have been stolen or looted, are easy to keep in private hands. In fact, it is difficult to identify books that have been looted or stolen. The principle clue to solving the origin of this Rost volume was the "Luebeckische Stadt-Bibliothek" stamp on the verso of the titlepage (Fig. 6) with no indication that it was legally withdrawn from the collection. This article about a book and its history from the looting to its restitution may also be understood as an appeal to return cultural goods that have been looted to their rightful owners.

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We suggest the following format for citing this article:
Jacobs, H. J. 2023. Heinrich Rost's facsimile of Hermann Schlegel's "Abbildungen neuer oder unvollständig bekannter Amphibien". A unique volume – looted, rediscovered, and repatriated to the Lübeck Library. *Bibliotheca Herpetologica* 17(4):32–45.

Appendix

Rost's library – title list with indication on repatriation

The following list documents the incredible wealth of Rost's library. To have copied all 69 volumes by hand is not only evidence of tremendous diligence, but also of a never-ending motivation. Here I largely follow the catalogue of the Herzog August Bibliothek Wolfenbüttel, which is a conversion of old handwritten catalogues of the Stadtbibliothek Lübeck from the early 17th to the 20th. Additionally corrections from the Stadtbibliothek Lübeck have been incorporated (Britta Lukow, pers. comm.). Handwritten remarks and information concerning the status of the respective volume, by means of a small stamp in the catalogue of the library (see https://digitalstadtbibliothek.luebeck.de/viewer/image/1447231461037/11/), are incorporated in the third column. In the case of handwritten indications of the different return countries the country abbreviations are maintained: DDR (Deutsche Demokratische Republik=GDR; SB Berlin= Staatsbibliothek Berlin), SU (Soviet Union) and UdSSR (Union der Sozialistischen Sowjetrepubliken).

In a few cases, for instance vol. 40 and 45, the order of the volumes differs between the old systematic list and the list used today, which I also follow here.

The title that is the focus of attention here is found in position 21: H. Schlegel: "Abbildungen neuer oder unvollständig bekannter Amphibien".

Of the former 69 volumes at the moment 50 must be considered lost. 8 volumes were returned from the Soviet Union, 8 more from the German Democratic Republic and 1 from Armenia.

1. Eduard Rüppel: Atlas zu der Reise im nördlichen Afrika. a. Säugetiere; bearbeitet von Cretzschmar, Frankfurt am Main 1826. Titelblatt + 14 Seiten ursprüngliche Zählung mit erklärendem Text für alle Abteilungen + 30 farbigeTafeln. b. Vögel; bearbeitet von Cretzschmar, Frankfurt am Main 1826. Titelblatt + 35 farbige Tafeln. c. Reptilien; bearbeitet von C. H. G. von Heyden. Frankfurt am Main 1827. Titelblatt + 6 farbige Tafeln. d. Fische des rothen Meers; bearbeitet v. E. Rüppell. Frankfurt am Main 1828. Titelblatt + 35 farbige Tafeln auf 26 S.

   Eduard Rüppell: Neue Wirbeltiere zur Fauna von Abyssinien gehörig. a. Säugetiere, Frankfurt am Main 1835. Titelblatt + 14 farbige Tafeln, b. Vögel; Frankfurt am Main 1835. Titelblatt + 30 farbige Tafeln, c. Amphibien; Frankfurt am Main 1839. Titelblatt + 5 farbige Tafeln, d. Säugetiere; Auszug des Textes; 6 Seiten. **[lost]**

2. Maximilian Prinz Von Wied-Neuwied: Abbildungen zur Naturgeschichte Brasiliens. 15 Lieferungen. Weimar 1822–1831. **[lost]**

3. Osteologie. Abbildungen zur Osteologie der Thiere, nach verschiedenen grösseren Werken gesammelt und gezeichnet. Zuerst die Zähne: 1 Bl. Text + 5 Tafeln; 3. die Vögel: 3 S. Text + 17 Tafeln; 4. Amphibien: 1 Bl. Text + 7 Tafeln; 5. Fische: 3 S. Text + 6 Tafeln. **[present]**

4. 1–82 Crustaceen. Bemerkungen zu verschiedenen Crustaceen, gesammelt nach grösseren Werken. 2 Titelblätter + 82 S. ursprüngliche Zählung; gemäß der 2 Titelblätter nach Bd. 8 und 10 der Encyclopedie methodique, 1811 und 1825; später nach W. E. Leach und anderen Autoren.

   1–66 Arachnidae. Auszüge über Arachnidae. Titelblatt + 66 S. ursprüngliche Zählung; nach Latreilles, Genera crustaceorum et insectorum, Paris 1806 und der erweiterten Enzyklopaedia und anderen Autoren.

   1–37 Akalephen. Bemerkungen über Acalephen (Meernesseln, Medusen) nach verschiedenen Werken. Titelblatt + 37 S. ursprüngliche Zählung.

   1–59 Radiarien, Echinodermata. Über Radiarien und Echinodermata Auszüge aus verschiedenen grösseren Werken. 2 Titelblätter + 59 S. ursprüngliche Zählung; Hauptsächlich ein genauer Auszug aus Lamark, Histoire naturelle des animaux sans vertèbres, Paris 1816. **[returned from UdSSR, present]**

5. Tafelband zu dem vorigen Manuskript.

   1–7 Krustacea. Titelblatt + 7 S. ursprüngliche Zählung mit erklärendem Text + 32 Tafeln, darunter einige farbige.

   1–16 Arachniden. Titelblatt + 16 S. erklärender Text + 50 Tafeln mit meist farbigen Abbildungen.

   1–3 Echinodermata. Echnodermata. Titelblatt + 3 S. erklärender Text + 9 farbige Tafeln.

   1–3 Mollusken. Mollusca. Titelblatt + 3 S. erklärender Text + 14 farbige Tafeln.

1–3 Anneliden. Titelblatt + 3 S. erklärender Text + 14 farbige Tafeln.

1–2 Acalephae. Acalephae. Titelblatt + 2 S. erklärender Text + 11 farbige Tafeln.

1–5 Eutozoe. Eutozoe. Titelblatt + 5 S. erklärender Text + 14 meist farbige Tafeln.

1–7 Polypie. Polypi. Titelblatt + 7 S. erklärender Text + 39 z. T. farbige Tafeln (+ 1 Tafel 23a). **[lost]**

6. Polypen. Auszüge aus grösseren Werken über Polypen, namentlich auch über die Korallen. 2 Titelblatt + 208 S. ursprüngliche Zählung; mit eigenen Zusätzen; hauptsächlich nach Lamark.

   Anneliden. Die Anneliden. Titelbatt + 31 (?) S., hauptsächlich nach Savigny. **[returned 1989 from DDR / Potsdam, present]**

7. Lamark. Histoire naturelle des animaux sans vertèbres, Paris 1815 ff. Auszüge aus den 5 Bänden der Kieler U.B. über Infusorien, Rodiarien, Tunicate, Vermes, Insecta, Arachniden, Crustaceen, Anneliden. **[returned 1989 from DDR / Potsdam, present]**

8. 1–262 Säugetiere (Text). Über Säugetiere. Auszüge aus grossen Werken und Abhandlungen. Bd. I. Titelblatt + 262 S. ursprüngliche Zählung.**[lost]**

9. Säugetiere (Abhandlung). Abbildungen seltener und wenig bekannter Säugetiere aus verschiedneen grösseren Werken. Titelblatt + 7 S. Text + 60 größtenteils farbige Tafeln.**[lost]**

10. Ornithologie. Ornithologische Excerpte aus verschiedenen grösseren Werken. I. Titelblatt + 1. Auszug aus Prinz Maximilian von Wied Beiträgen zur Naturgeschichte Brasiliens III, 1. Die Vögel. Weimar 1830. Titelblatt + 22 S.; III, 2. Die Vögel. Weimar 1831. Titelblatt + 28 S.; IV, 1,2. Die Vögel. Weimar 1832. Titelblatt + 38 S. 2. L. C. Bonaparte: Die Sippen der nordamerikanischen Vögel ... aus Okens Isis 1832 .. Titelblatt + 59 S. 3. Auszug aus (The Cabinet Cyclopaedia) On the natural history and Massification of birds by Will Swainson. 2 Vol. London 1836. Titelblatt + 64 S. Auf einige leere Bl. folgen 17 Tafeln mit Vogelköpfen. 4. Systematisches Verzeichnis der Europaeischen Vögel nach H. Graf Keyserling u. .. J. H. Blasius, Die Wirbeltiere Europas, 1840. Titelblatt + 44 S. 5. C. L. Bonaparte: ... Versuch einer methodischen Eintheilung der Wirbelthiere ... Isis 1832. 15 ungezählte Bl.**[lost]**

11. Ornithologie. Bd. I. Ornithologie in Auszügen aus Okens ISIS. Von Anfang bis Jahrgang 1830. Titelblatt + 171 S. + 10 Bl. Register. **[lost]**

12. Ornithologie. Bd. II. Ornithologie in Auszügen aus Okens ISIS. Von 1831 bis 1838 inklusive. Titelblatt + 243 S. **[lost]**

13. Fortsetzung von Ms. nat. 4° 10.

    Ornithologische Excerpte aus verschiedenen grössern Werken. II. Titelblatt + 63 S. 2. Bemerkungen über die Farbe und Zeichnung der Vogeleier nach verschiedenen Schriftstellern. Titelblatt + 34 S. **[lost]**

14. Fortsetzung von Ms. nat. R 10 und Ms. nat. R 13. Ornithologie. Ornithologische Excerpte aus verschiedenen grössern Werken. III. Titelblatt + 264 S.; auf der Rückseite des Titelblattes ein Verzeichnis der exzerpierten Werke. **[returned from SU, present]**

15. Anders Sparrman: Museum Carlsonianum in quo novas et selectas Aves coloribus ad vivum illustratas escrib. Fasc. I–III. Holmiae 1786 sq. Titelblatt + 6 S. Text + 74 Tafeln.

    Carl Wilhelm Hahn: Voegel aus Asien Africa America und Neuholland in Abbildungen nach der Natur. Lief. I–XII, Nürnberg 1822. Titelblatt + 3 S. Text + 12 x 6 Tafeln.

    John Latham: Abbildungen von Voegeln nach Lathams Synopsis. Titelblatt + 2 S. Text + 31 Tafeln. **[lost]**

16. Eduard Rüppell: Systematische Übersicht der Vögel Nord-Ost-Afrikas ... Frankfurt am Main 1845. Titelblatt + 27 S. Text + 50 farbige Tafeln. **[lost]**

17. Lesson: Traité d' Ornithologie ... Paris 1831. Titelblatt + 192 S.; Auszug nicht nur das neueste, besonders aussereuropäische über Vögel u. a. interessante Bemerkungen berücksichtigend, sondern jede Species.

    Georg Robert Gray: A List of the Genera of Birds ... London 1841. Titelblatt + 117 S. **[lost]**

18. Reptilien. Titelblatt + 17 S. Text + 83 meist farbige Tafeln; auf dem Titelblatt, wohl von anderer Hand, die Bezeichnung: IV; vergleiche die nachfolgenden Manuskripte und Ms. 23. Als 18. Stück verzeichnet die systematische Liste: H. von Rost (Abbild. Text) v. Vogeleiern in besonderer Mappe. Tafel 1–8. **[lost]**

19. Reptilien. Auszüge aus grössern Werken über Reptilien, Bd. I. Titelblatt + 304 S. **[back from SU, present]**

20. Auszüge aus grössern Werken über Reptilien Bd. II. Titelblatt + 57 S. **[lost]**

21. **H. Schlegel: Abbildungen neuer oder unvollständig bekannter Amphibien... mit einem erläuternden Text. Düsseldorf 1837–1844. Titelblatt + 6 S. + 50 farbige Tafeln.** **[lost; returned in May 2023]**

22. Blasius Merrem: Beiträge zur Geschichte der Amphibien... 1790. Titelblatt + 2 x 12 farbige Tafeln.

    Johann David Schöpf: Naturgeschichte der Schildkröten... 34 Tafeln. Titelblatt + 3 S. Text + 31 farbige Tafeln (+ Tafeln 17b, 18b, 30b). **[lost]**

23. Reptilien. Abbildungen von Reptilien; aus verschiedenen grösseren Werken gesammelt. Titelblatt + 2 S. Text + 17 farbige Tafeln; auf dem Titelblatt. **[lost]**

24. Piet Cramer: Uitlandsche Capellen (ausländische Schmetterlinge), aus Asien, Africa und America... Amsterdam 1779 sq. Tom. I. II; Titelblatt + 192 farbige Tafeln + 6 ungezählte Bl. Register. Unter Nr. 24 verzeichnet die systematische Liste: H. von Rost (Abbild) Physionomie der Schlangen nach H. Schlegel, Amsterdam, 1837, Tafel 1-25. **[lost]**

25. Piet Cramer: Uitlandsche Capellen (ausländische Schmetterlinge), aus Asien, Africa und America... Amsterdam 1779 sq. Tom. III. IV; Titelblatt + Tafel 193–400 + 17 ungezählte Bl. Register. Unter Nr. 25 verzeichnet die systematische Liste: H. von Rost (Abbild) Krabben und Krebse nach Herbst Tafel 1-62. **[lost]**

26. Käfer. Käfer-Abbildungen nach verschiedenen grösseren Werken Bd. I. Titelblatt + 132 meist farbige Tafeln + 1 Bl. Quellenverzeichnis + 69 S. Register. Unter Nr. 26 verzeichnet die systematische Liste: H. von Rost (Abbild) 24 Arten kurzschwänziger Krabben nach Dr. Eduard Rüppel l, Frankfurt am Main 1830. Tafel 1–5. (NB. in der Mappe zur Osteologie). **[lost]**

27. Käfer. Auszüge aus verschiedenen grösseren Werken die Käfer (Coleoptera) betreffend Bd. I. Mit getrennter Seitenzählung und 5 Tafeln mit Federzeichnungen. **[returned from the DDR with archive material, present]**
28. Käfer. Auszüge aus verschiedenen grösseren Werken die Käfer (Coleoptera) betreffend Bd. II. Titelblatt + 290 S. **[lost]**
29. Käfer. Auszüge aus verschiedenen grösseren Werken die Käfer (Coleoptera) betreffend Bd. III. Titelblatt + 301 S. **[returned from the DDR with archive material, present]**
30. Käfer. Collectaneen über Käfer aus verschiedenen grösseren Werken IV. Titelblatt + 98 S. **[returned 1989 from DDR / SB Berlin, present]**
31. Orthoptera. Orthoptera. Titelblatt + 11 S. Text + 47 meist farbige Tafeln.

    Neuroptera. Neuroptera. Titelblatt + 8 S. Text + 31 meist farbige Tafeln.

    Hemiptera. Hemiptera. Titelblatt + 16 S. Text + 16 meist farbige Tafeln + 5 S. Text + 12 zum Teil farbige Tafeln.

    Diptera. Diptera. Titelblatt + 27 S. Text + 43 meist farbige Tafeln. **[returned 1989 from DDR / SB Berlin, present]**
32. Hymenoptera. Hymenoptera nach verschiedenen Werken. Titelblatt + 39 S. Text + (77 + 60) meist farbige Tafeln. Unter Nr. 32 verzeichnet die systematische Liste H. von Rost (Abbild) Wanzenart. Insecten nach C. W. Hahn und G. W. Herrich-Schäffer, Nürnberg 1831 sq. Bd. 1–5; Fig. 1–558. **[lost]**
33. G. W. F. Panzer: Faunae Insectorum germanicae initia oder Deutschlands Insecten... Jahrg. 1–10 (109 Hefte) Nürnberg 1799–1810. Titelblatt + 9 x 288 + 24 meist farbige Figuren. **[returned from SU, lost]**
34. Panzer, G. W. F.: Faunae Insectorum germanicae initia oder Deutschlands Insecten... Jahrg. 1-10 (109 Hefte) Nürnberg 1799–1810. Titelblatt + 258 S. + 11 Bl. **[returned from SU, present]**
35. Entomologie. Auszüge aus verschiedenen Werken die Schmetterlinge betreffend. Titelblatt + 171 S.

    Entomologie. Auszüge aus verschiedenen Werken die Orthoptera betreffend. Titelblatt + 83 S.

    Entomologie. Auszüge aus verschiedenen Werken die Neuroptera betreffend. Titelblatt + 27 S.

    Entomologie. Auszüge aus verschiedenen Werken die Piezata (Hymenoptera) betreffend. Titelblatt + 125 S.

    Entomologie. Auszüge aus verschiedenen Werken die Hemiptera betreffend. Titelblatt + 103 S.

    Entomologie. Auszüge aus verschiedenen Werken die Diptera betreffend. Titelblatt + 57 S. + 2 S.

    Entomologie. Die entomologische Literatur von 1790–1800 (nach Oken) und von 1800–1817 (nach Germar). Titelblatt + 9 ungezählte Bl. **[returned 1989 from DDR / SB Berlin, present]**
36. L. Jurine: Nouvelle méthode de classer Les Hymenoptères. Geneve 1807. Titelblatt + 50 S.; Auszug („*die Kupfertafeln habe ich getrennt binden lassen*“).

    Hymenoptera. Classification nebst Angabe unterscheidender Merkmale vieler Hymenopteren-Arten nach Encyclopedie methodique Bd. 10 (1825). Titelblatt + 138 S. **[returned from SU, present]**
37. August Ahrens: Fauna Insectorum Europae cura E. F. Germar. Halae 1812 sq. Titelblatt + Tafeln mit 13 x 25 farbigen Figuren + 43 S. Text. **[lost]**
38. J. L. Christ: Naturgeschichte, Classification und Nomenclatur der Insecten vom Bienen-, Wespen- und Ameisengeschlecht mit 60 Kupfertafeln. Frankfurt am Main 1791. Titelblatt + 58 S. enthalten nur Text.

    William Kirby: Monographia Apum Angliae with 18 Plates. Ipswich 1802. Titelblatt + 27 S. Text.

    Latreille: Genera Crustareorum et Insectorum. Paris und Strassburg 1807; Die Hymenopteren im Auszug. Titelblatt + S. 31–64.

    Latreille: Histoire naturelle des Fourmis. Paris 1802. Die Ameisen. Titelblatt + S. 67–78 Text. **[lost]**
39. Spanner. Die Spanner. Titelblatt + 16 S. Text + 52 farbige Tafeln (1 und 2 zusammen) nach Esper + 12 farbige Tafeln nach Schäffer, Iconographie. **[lost]**
40. Unter Nr. 40 führt das alte systematische Verzeichnis auf. H. Rost (Abbild) nach Caspar Stoll, Amsterdam 1787 a. Heuschrecken Tafel 1–12; b. Cicaden Tafel 1–10; c. Wanzen Tafel 1–12. Dieser Band, der die alte Nummer 64 führte, konnte nicht mehr aufgefunden werden; siehe Kat. nat. 4° 753.

    Theodor Hartig. Die Aderflügler Deutschlands. 1. Bd. (5. titel (?): die Familie der Blatt- und Holzwespen) Berlin 1837. Titelblatt mit dem Vermerk: im Auszuge (genau) + 66 S. + 2 Tafeln.

    J. L. C. Gravenhorst. Ichneumonologia europea. Pars I, II, III c. expm. Breslau 1828 sq. Titelblatt mit dem Vermerk: *im genauen Auszuge* + 251 S. **[returned from SU, present]**
41. Conchylien. Abbildungen von Conchylien aus verschiedenen grösseren Werken. Titelblatt + 30 S. Text + 81 zum Teil farbige Tafeln. **[lost]**
42. Georg Wolfgang Knorr: Vergnügen der Augen und des Gemüths, I–VI. Nürnberg 1757–1772. Titelblatt + 17 farbige Tafeln mit Conchylien, die im Martini-Chemnitrischen Werke garnicht, oder anders dargestellt sind .. + 8 S. Text.

    Conchylien. Conchylien aus der Encyclopedie Methodique. Titelblatt + 71 Tafeln derselben Ausgabe wie 1 + 15 S. Register. **[lost]**
43. Martini Chemnitz. Systematisches Conchylien-Cabinet. Titelblatt + 193 S. farbige Tafeln. Bd. 1–5 + 14 ungezählte Bl. Register. **[lost]**
44. Martini Chemnitz. Systematisches Conchylien-Cabinet. Titelblatt + 173 S. farbige Tafeln. Bd. 6–10 + 10 weitere Tafeln + 14 Bl. Register. **[present]**
45. Karl Theodor Menke: Synopsis methodica Molluscorum ... Pyrmont 1830. **[lost]**
46. Lamark: Histoire naturelle des animaux sans vertèbres. Die Cirrhipeden und Conchiferen (Classe 10 und 11). Titelblatt + 144 S. in genauen Auszuge. **[lost]**
47. Pierre Denys De Montfort: Histoire Naturelle des Mollusques I–IV. Paris Anno 10. Titelblatt + 50 Tafeln + 10 S. Text. **[lost]**
48. Conchylien. Auszüge aus verschiedenen Werken die Conchylien betreffend. Bd. I, II, III. Titelblatt + 293 S.; beginnt mit dem Auszug von Pfeiffers Systematischer Anordnung und Beschreibung deutscher Land- und Flußschnecken, 1821. **[lost]**

49. Conchylien. Auszüge aus verschiedenen Werken die Conchylien betreffend. Bd. I, II, III. Titelblatt + 216 S. + Titelbatt zu Bd. III + 18 S. **[lost]**

50. Mollusken. Mollusca und Quallen. Titelblatt + 3 S. Text + 23 farbige Tafeln. **[lost]**

51. Rudolf Amandus Philippi: Fauna Molluscorum viventium in tellure tertiaria fossilium. Regni utriusque Siciliae Vol. II. 1844. Titelblatt + 140 S. Text + 11 Tafeln. **[lost]**

52. Carl Pfeiffer: Naturgeschichte deutscher Land- und Süsswasser-Mollusken, ... Weimar 1821–1828. Titelblatt + 10 S. Text + 20 farbige Tafeln.

    B. von Spix, J. A. Wagner: Testacea fluviatilia Brasiliensia ... München 1827. Titelblatt + 6 S. Text + 14 farbige Tafeln.

    William Swainson: Exotic Conchology ... London 1841. Titelblatt + 10 S. Text + 48 farbige Tafeln. **[lost]**

53. Mollusken. Die Mollusken, Auszüge aus den hieher gehörenden Artikel der Encyclopedie methodique ... . Titelblatt + 293 S.; systematisch geordnet nach Mencke synopsis methodica Molluscorum, 1830. **[lost]**

54. Draparnaud: Histoire naturelle des Mollusque terrestres et fluviatiles de la France avec planches, Paris an XIII. (1805). Titelblatt + 30 S. Text + 14 Tafeln.

    Johann Wilhelm von Alten: Systematische Abhandlung über die Erd- und Flussconchylien, welche um Augsburg und umliegende Gegenden gefunden werden. 1812. Titelblatt + 8 S. Text + 2 farbige Tafeln.

    Jacob Sturm: Deutschlands Fauna. 6. Abteilung. Die Würmer. 1803 sq. Titelblatt + 23 S. Text + 23 farbige Tafeln.

    Th. Müller: Synopsis novorum generum, specierum et varietatum testaceorum viventium ... 1836. Titelblatt + 122 S. Text; *extractivisch übersetzt (fast wörtlich).* **[lost]**

55. E. J. C. Esper: Pflanzenthiere. Nürnberg 1788–1809, I, II. Bd. I: Titelblatt + 211 farbige Tafeln + 3 Bl. Register. **[lost]**

56. E. J. C. Esper: Pflanzenthiere. Nürnberg 1788–1809, I, II. Bd. II: Titelblatt + Tafel 212–340 + 48 S. Text + 16 S. Register. **[lost]**

57. Versteinerungen. Versteinerungen nach verschiedenen Werken. I–IV. Titelblatt + Verzeichnis der ausgezogenen Werke, + 20 Tafeln + 5 S. Text + 33 Tafeln + 10 S. Text + 16 Tafeln + 7 S. Text + 13 Tafeln + 4 S. Text + 7 Tafeln + 6 S. Text + 12 Tafeln + 3 S. Text + 3 Tafeln + 1 S. Text + 75 Tafeln + 13 S. Text + 8 Tafeln + 2 S. Text. **[present]**

58. Versteinerungen. Versteinerungen nach verschiedenen Werken. I–IV. Titelblatt + Verzeichnis der ausgezogenen Werke, + 181 Tafeln + 5 S. Text. **[lost]**

59. Versteinerungen. Versteinerungen nach verschiedenen Werken. I–IV. Titelblatt + 84 S. Text + 157 Tafeln + 11 S. Text + 21 Tafeln; diese letzteren sind als 4. Bd. bezeichnet. **[lost]**

60. Versteinerungen. Auszüge aus verschiedenen grösseren Werken, die Petrefaktenkunde betreffend. Bd. 1, 2. Titelblatt + Verzeichnis der ausgezogenen Werke; getrennte Paginierung; 1 halbes Bl. mit Federzeichnungen. **[lost]**

61. Versteinerungen. Auszüge aus verschiedenen grösseren Werken, die Petrefaktenkunde betreffend. Bd. 1, 2. Titelblatt + Verzeichnis der ausgezogenen Werke + 425 S. **[returned 1989 from DDR / SB Berlin, present]**

62. Pictet: Anleitung zur Palaeontologie (Traité élémentaire de Pal.) oder Naturgeschichte der fossilen Thiere ... 4 Bde Genf 1846. Titelblatt + 365 S. *im genauesten Auszuge* + 18 S. Register + 12 Bl. Register. **[returned from SU, present]**

63. Hanns Bruno Geinitz: Charakteristik der Schichten und Petrefacten des sächsisch-böhmischen Kreidegebirges . 1839. Titelblatt + 27 S. Text + 18 Tafeln.

    L. Agassiz: Etudes critiques sur les mollusques Fossiles ... Neuchatel 1892. Titelblatt + 6 S. Text + 27 Tafeln.

    L. Agassiz: Iconographie des Coquilles Tertiaires ... 1845. Titelblatt + 4 S. Text + 15 Tafeln.

    M. P. H. Nyst: Description Des Coquilles Et Des Polypiers Fossiles Des Terrains Tertiaires De La Belgique ... 1846. Titelblatt + 35 S. Text + 24 Tafeln. **[lost]**

64. James Sowerby: Mineral-Conchology Grossbritanniens ... deutsche Bearbeitung ... von Agassiz. 1840. Titelblatt + 10 S. Text + 60 farbige Tafeln. **[returned from Armenia, present]**

65. Geologie. Geologie Deutschlands. Titelblatt + 9 S. mit 4 Tafeln + leeres Bl. + 16 Bl.; (cf. Dr. Giebel, Gaea excursoria germanica. Leipzig 1848) Extract, mit Hinweisungen auf Pickets Paläontologie, Bd. 4.

    Grauwackengebirge. Verzeichnis der organischen Reste des Grauwacken- oder Übergangsgebirges in Europa. Titelblatt + 28 S. nach Sedgwick und Murchison von Leonhardt (Stuttgart 1844) und Roemer über das Rheinisch. Übergangsgebirge, Hannover 1844. **[lost]**

66. J. W. Dalman: Über die Palaeaden oder die sogenannten Trilobiten. Aus dem Schwedischen von Friedrich Engelhart. 1828. Titelblatt + 12 S. Text + 6 Tafeln.

    Hermann Burmeister: Die Organisation der Trilobiten ... 1843. Titelblatt + 16 S. Text + 7 Tafeln. **[lost]**

67. Paläontologie. Abbildungen zur Paläontologie, meist aus Cuvier, Recherches sur les ossemens dès Quadrupsèdes und anderen Quellen ... . Titelblatt + Verzeichnis der Tafeln + 56 Tafeln + 5 geologische Karten. **[lost]**

68. Heinrich G. Bronn: System der Urweltlichen Konchylien. 1824. Titelblatt + 22 S. + 15 S. Text + 7 Tafeln.

    Heinrich G. Bronn: >System der Urweltlichen Pflanzenthiere ... 1825. Titelblatt + 15. S. Text + 7 Tafeln.

    Friedrich Adolph Roemer: Die Versteinerungen des Harzgebirges ... 1843. Titelblatt + 6 S. Text + 12 Tafeln. **[lost]**

69. Dejean: Catalogue des Coléoptères de la Collection de M. Le Comte Dejean. A Paris 1833. Ein Exemplar des Kataloges, mit Papier durchschossen und mit handschriftlichen Zusätzen von Rosts Hand. **[lost]**

International Society for the History and Bibliography of Herpetology
Bibliotheca Herpetologica

Promoting Amphibians and Reptiles in French Agriculture and Horticulture — Albert Larbalétrier and *La Grenouille*

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The history of frog farming in North America was described by Mark Jennings and myself in *Bibliotheca Herpetologica* (Dodd and Jennings 2021). We noted that early booklets advocating frog farms often were not "how-to" manuals, but were more calls to look into the feasibility of rearing frogs in order to supply urban restaurants with reliable supplies of savory frog legs.

The first booklet to discuss the potential for frog farming in the United States was by Frederic Morton Chamberlain (1897) that provided information on the value of frogs as food, frog hunting, basic life history information, the species that might serve as food, and suggestions for frog culture. His advice was mostly directed to gathering tadpoles for stocking wetlands and letting the frogs do the rest. Chamberlain's booklet was followed by a number of other regionally produced booklets by Samuel Coombes, F.E. Bierbrier, and Henry George Santen that used a narrative format to encourage stocking frogs in an attempt to produce them for culinary markets (see Dodd and Jennings 2021 for details). In the late 1800s to early 1900s, a similar idea was being promoted simultaneously in France.

Albert Larbalétrier (1863–1902?) was Professeur de l'École Pratique d'Agriculture du Pas-de-Calais, among other positions[1]. As the name suggests, this and similar schools of practical agriculture were established to provide hands-on experience in farming regionally throughout France (Charmasson et al. 1999). In the United States today, we would call Larbalétrier an Agricultural Extension Service professor, as he published a great many books, booklets, and articles assisting farmers and gardeners in raising agricultural products (both plants and animals), combating pests, promoting new ideas in agricultural practices, discussing the importance of soil chemistry, and in recognizing animals and plants beneficial to farmers and gardeners. His major work was published in 1888 as *l'Agriculture et la Science Agronomique* (C. Reinwald, Paris), but it contains nothing on amphibians and reptiles.

Larbalétrier was a proponent of diversifying agricultural opportunities, and frogs were a part of his strategy. Frog legs have long been esteemed in France, yet their supply depended on gathering frogs from wild populations. Larbalétrier's first publication on the potential for farmers to diversify their income by raising frogs was in 1899, with a second in 1901, followed by his important booklet on frogs in agriculture, *La Grenouille*, published in 1902. He also published several other papers on both useful and potentially harmful amphibians and reptiles to horticulture (see below).

La Grenouille. Son histoire, ses moeurs, son élevage, etc., Recettes culinaires was published in 1902 by Le Bailly, Éditeur, O. Bornemann, Paris (Fig. 1), and reprinted in 1926 and 1943 by S. Bornemann, Éditeur, Paris (Fig. 2), publishers of many similarly-formatted booklets dealing with agricultural topics. The booklet is undated[2, 3], and consists of 31 pages. The only illustrations are those facing the title page (Fig. 3). As in the aforementioned U.S. booklets, material on frogs is presented in a narrative format, including information on the natural history of frogs, metamorphosis, identifying characters, anatomy, species to be found in France, behavior, utilization, and enemies. These topics cover the first 21 pages (e.g., Fig. 4). Pages 21 to 24 provide guidance on rearing frogs that generally follow Chamberlain's advice on stocking frogs in wetlands, protecting them from enemies, ensuring adequate aquatic and shoreline vegetation, and basically letting them grow by themselves. Larbalétrier noted the need to keep water clean from a buildup of frog egg jelly following hatching that might foul the water and cause mortality, and he gave information on when and how to harvest frogs for market. The final pages of text discuss other French anurans (but only hylids and toads) and note their beneficial attributes as insectivores. He even suggests that toads are better to use in greenhouses, since hylids might break the branches of horticultural plants!

In the United States and Canada, several publications appeared during the same era that touted the usefulness of frogs as insectivores and the benefits of having them on farms for controlling pests (Kirkland 1897; Miller 1909; Surface 1913; Storer 1914; Patch 1918; Wright 1920; Pack 1922). Albert Larbalétrier took a similar approach in France in the late 19th and early 20th centuries.

Parent's (1982) extensive bibliography of French herpetology does not include 5 of the 7 references cited below, perhaps suggesting the obscurity of extension publications outside of the agricultural community and reflecting Larbalétrier's relatively young age at the time of his death. His obituary suggests that he was well-respected by his agricultural colleagues[1].

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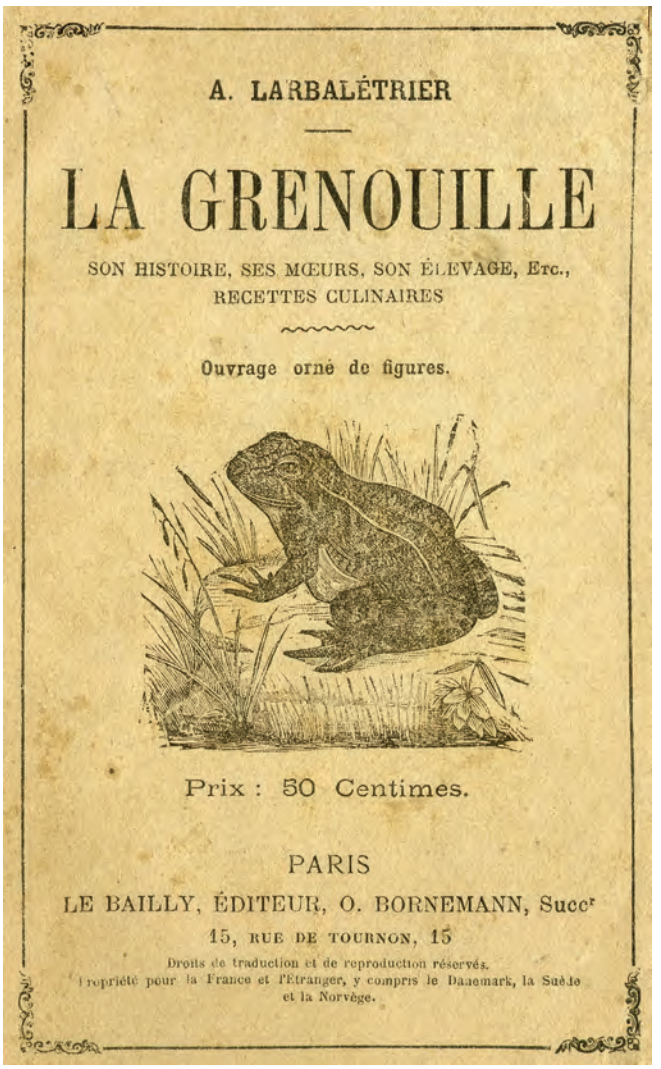
A. LARBALÉTRIER
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Fig. 1. Cover of the 1902 edition of *La Grenouille*.

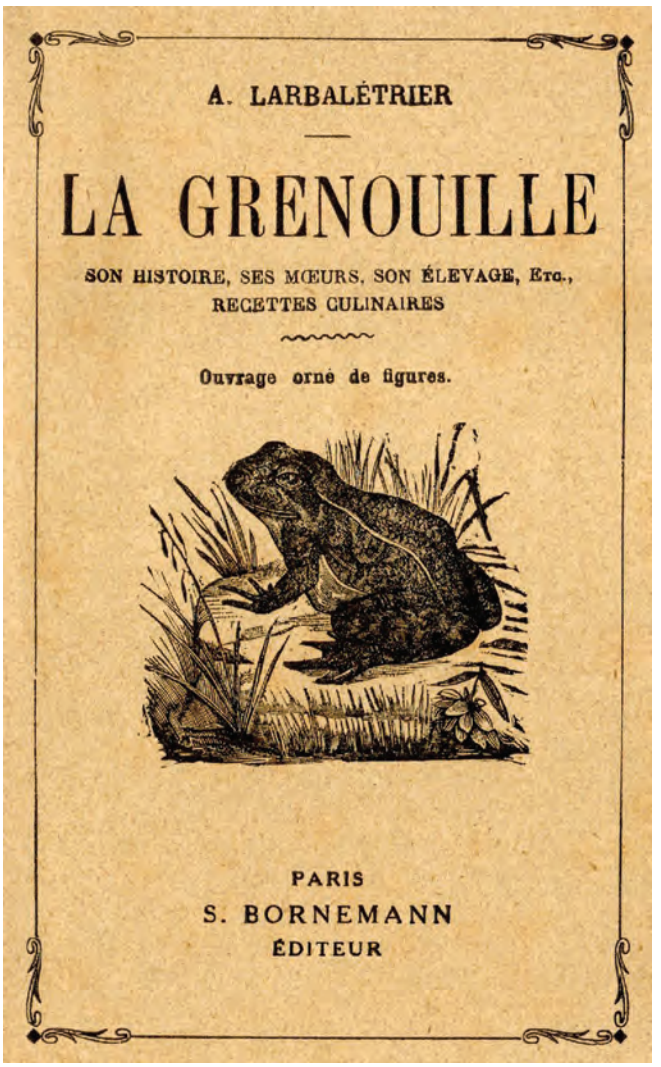

Fig. 2. Cover of the 1943 edition of *La Grenouille*.

Acknowledgments

I thank Annemarie Ohler for looking for information on Larbalétrier and *La Grenouille*. Chris Bell provided additional information on the publication dates and publisher of *La Grenouille*. Patrick David provided brief comments on the manuscript.

Notes

1. Albert Larbalétrier's obituary appears in the 12 April 1902 edition of Le Cosmos, No. 898, p. 447. No exact date of death is given. His many academic associations are included in the obituary. I have been unsuccessful in locating a portrait.
2. A single copy of the 1902 edition is listed in WorldCat from the Harvard University library. I have been unable to verify the printer.
3. The booklet was reprinted in 1926 by Imp. E. Veillon, Rue Péligot, Enghien-les-Bains and in 1943 by Imp. Paul DuPont, Paris. Although no date is specifically identified on the cover or title page, the print information is located at the bottom of the page containing the Table des Matières at the end of the booklet.

References

Chamberlain, F.M. 1897. Notes on the edible frogs of the United States and their artificial propagation. *U.S. Bureau of Fisheries for 1897*:249–261.

Charmasson, T., M. Duvigneau, A.-M. Lelorrain, and H. Le Naou. 1999. *L'enseignement Agricole. 150 ans d'histoire. Évolution historique et atlas contemporain.* Educagri éditions, Dijon, France. 251 pp.

Dodd, C.K., Jr., and M.R. Jennings. 2021. How to raise a bullfrog — The literature on frog farming in North America. *Bibliotheca Herpetologica* 15:77–100.

Kirkland, A.H. 1897. The habits, food and economic value of the American toad, *Bufo lentiginosus americanus* (LeC.). *Hatch Experiment Station of the Massachusetts Agricultural College, Bulletin* No. 46.

Miller, N. 1909. The American toad (*Bufo lentiginosus americanus*, LeConte). A study in dynamic biology. *American Naturalist* 43:641–668.

Pack, H.J. 1922. Toads in regulating insect outbreaks. Copeia (107):46–47.

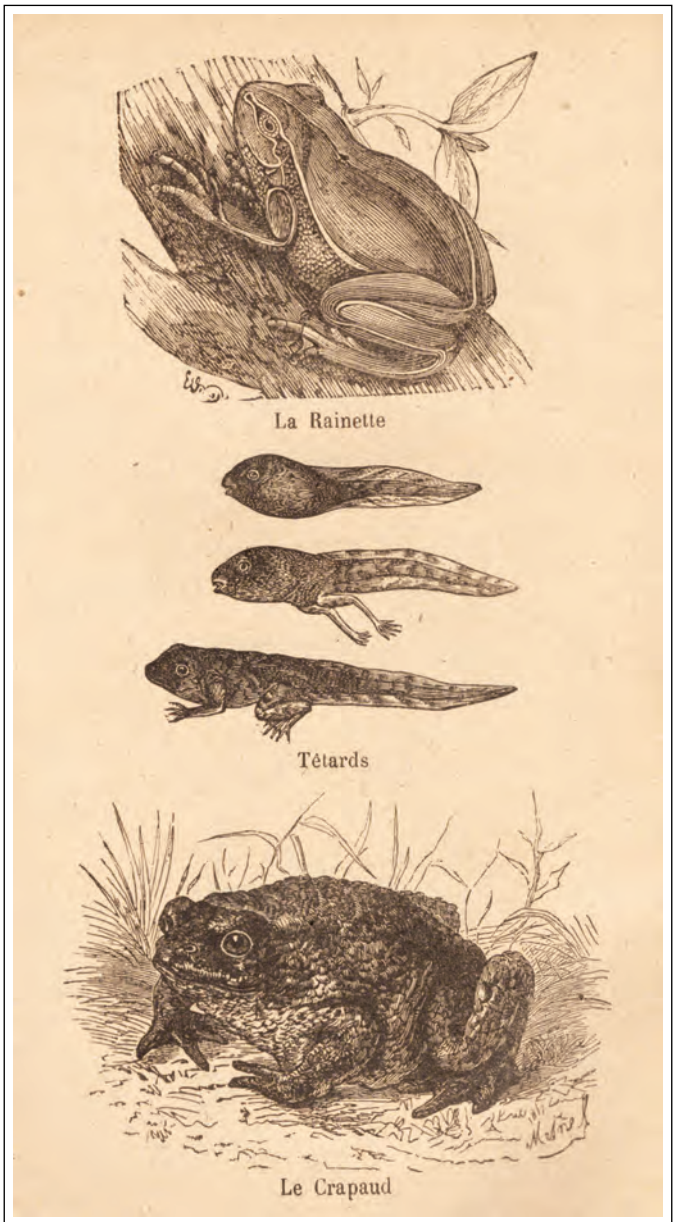

Fig. 3. Illustrations from the 1943 edition of *La Grenouille*. These illustrations appear in all editions.

Parent, G.H. 1982. *Bibliographie de l'Herpetofaune Française. Inventaires de Faune et de Flore, Fascicules 17 et 18*. Secretariat de la Faune et de la Flore, Paris. 431 pp.

Patch, C.L. 1918. The economic value of batrachians and reptiles. *Ottawa Naturalist* 32:29–30.

Surface, H.A. 1913. First report on the economic features of the amphibians of Pennsylvania. *Zoological Bulletin, Division of Zoology, Pennsylvania Department of Agriculture* 3:66–152.

Storer, T.I. 1914. The California toad, an economic asset. *University of California Journal of Agriculture* 2:89–91.

Wright, A.H. 1920. Frogs: Their Natural History and Utilization. *Department of Commerce, Bureau of Fisheries*, No. 888.

Publications of Albert Larbalétrier on amphibians and reptiles and their utility in French agriculture and horticulture

1894. Les serpents venimeux de France. La Science Illustrée 1894, Tome XII, No. 335, pp. 342– 343.

1897. Les Animaux Utiles et Nuisibles a l'Horticulture (Insectes Exceptés). Librairie Agricole de la Maison Rustique, Paris. [Amphibians and reptiles on pp. 92–110]

1899. Élevage des grenouilles. La Nature (Paris) 27(2):379.

1900. Le Crapaud. Ses moeurs – Légendes et préjugés – Son utilité le marché aux crapauds. La Nature (Paris) 28(2):294–295.

1901. Élevage de la grenouille. Le Cosmos – Revue des Sciences et de leurs Applications. Vol. 45, No. 874, pp. 520–522.

1902. La Grenouille. Son histoire, ses moeurs, son élevage, etc., Recettes culinaires. Le Bailly, Éditeur, O. Bornemann, Paris. 31 pp.

1926. La Grenouille. Son histoire, ses moeurs, son élevage, etc., Recettes culinaires. S. Bornemann, Éditeur, Paris. 31 pp. [Same text, different cover from 1902 edition; reprinted 1943]

We suggest the following format for citing this article:
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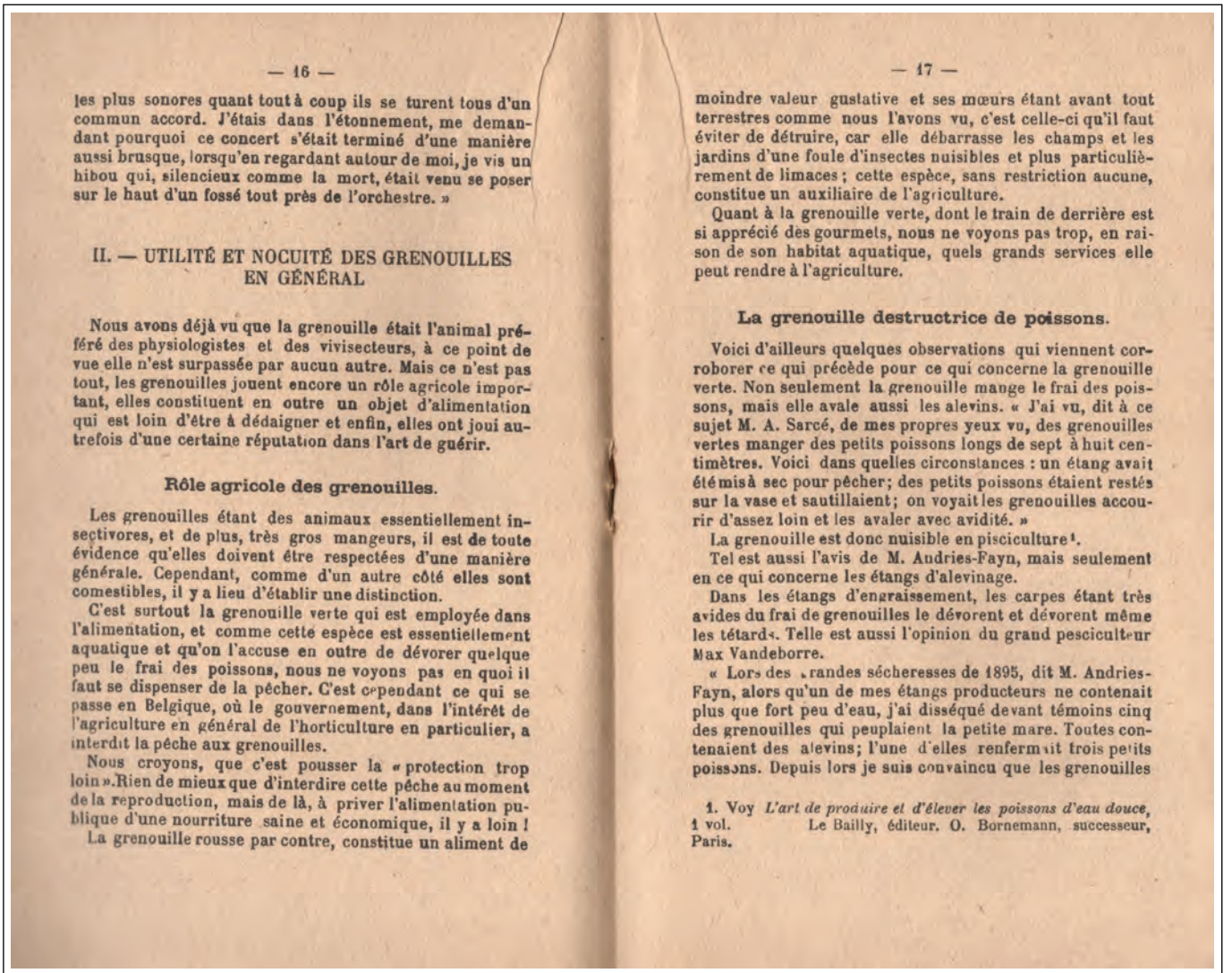

— 16 —

les plus sonores quant tout à coup ils se turent tous d'un commun accord. J'étais dans l'étonnement, me demandant pourquoi ce concert s'était terminé d'une manière aussi brusque, lorsqu'en regardant autour de moi, je vis un hibou qui, silencieux comme la mort, était venu se poser sur le haut d'un fossé tout près de l'orchestre. »

II. — UTILITÉ ET NOCUITÉ DES GRENOUILLES EN GÉNÉRAL

Nous avons déjà vu que la grenouille était l'animal préféré des physiologistes et des vivisecteurs, à ce point de vue elle n'est surpassée par aucun autre. Mais ce n'est pas tout, les grenouilles jouent encore un rôle agricole important, elles constituent en outre un objet d'alimentation qui est loin d'être à dédaigner et enfin, elles ont joui autrefois d'une certaine réputation dans l'art de guérir.

Rôle agricole des grenouilles.

Les grenouilles étant des animaux essentiellement insectivores, et de plus, très gros mangeurs, il est de toute évidence qu'elles doivent être respectées d'une manière générale. Cependant, comme d'un autre côté elles sont comestibles, il y a lieu d'établir une distinction.

C'est surtout la grenouille verte qui est employée dans l'alimentation, et comme cette espèce est essentiellement aquatique et qu'on l'accuse en outre de dévorer quelque peu le frai des poissons, nous ne voyons pas en quoi il faut se dispenser de la pêcher. C'est cependant ce qui se passe en Belgique, où le gouvernement, dans l'intérêt de l'agriculture en général de l'horticulture en particulier, a interdit la pêche aux grenouilles.

Nous croyons, que c'est pousser la « protection trop loin ».Rien de mieux que d'interdire cette pêche au moment de la reproduction, mais de là, à priver l'alimentation publique d'une nourriture saine et économique, il y a loin !

La grenouille rousse par contre, constitue un aliment de

— 17 —

moindre valeur gustative et ses mœurs étant avant tout terrestres comme nous l'avons vu, c'est celle-ci qu'il faut éviter de détruire, car elle débarrasse les champs et les jardins d'une foule d'insectes nuisibles et plus particulièrement de limaces ; cette espèce, sans restriction aucune, constitue un auxiliaire de l'agriculture.

Quant à la grenouille verte, dont le train de derrière est si apprécié des gourmets, nous ne voyons pas trop, en raison de son habitat aquatique, quels grands services elle peut rendre à l'agriculture.

La grenouille destructrice de poissons.

Voici d'ailleurs quelques observations qui viennent corroborer ce qui précède pour ce qui concerne la grenouille verte. Non seulement la grenouille mange le frai des poissons, mais elle avale aussi les alevins. « J'ai vu, dit à ce sujet M. A. Sarcé, de mes propres yeux vu, des grenouilles vertes manger des petits poissons longs de sept à huit centimètres. Voici dans quelles circonstances : un étang avait été mis à sec pour pêcher; des petits poissons étaient restés sur la vase et sautillaient; on voyait les grenouilles accourir d'assez loin et les avaler avec avidité. »

La grenouille est donc nuisible en pisciculture[1].

Tel est aussi l'avis de M. Andries-Fayn, mais seulement en ce qui concerne les étangs d'alevinage.

Dans les étangs d'engraissement, les carpes étant très avides du frai de grenouilles le dévorent et dévorent même les têtards. Telle est aussi l'opinion du grand pesciculteur Max Vandeborre.

« Lors des grandes sécheresses de 1895, dit M. Andries-Fayn, alors qu'un de mes étangs producteurs ne contenait plus que fort peu d'eau, j'ai disséqué devant témoins cinq des grenouilles qui peuplaient la petite mare. Toutes contenaient des alevins; l'une d'elles renfermait trois petits poissons. Depuis lors je suis convaincu que les grenouilles

1. Voy *L'art de produire et d'élever les poissons d'eau douce*, 1 vol. Le Bailly, éditeur. O. Bornemann, successeur, Paris.

Fig. 4. Pages 16–17 of *La Grenouille* introducing the importance of frogs in agriculture. The text is identical in all editions.

International Society for the History and Bibliography of Herpetology
Bibliotheca Herpetologica

Juan R. León-Ochoa (1937–2016): Pioneer of Herpetology in Venezuela

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The early history of herpetology in Venezuela is sketchy and based on reports of travellers to the "Indies," and naturalists who mentioned or named and illustrated species found for the first time in the Venezuelan territory between the 16th and 18th centuries (among them Galeotto Cey, an Italian trader; Pehr Löfling, a disciple of Linnaeus; and a Catholic missionary, Father Joseph Gumilla). Alexander von Humboldt, who spent time in Venezuela between 1799 and 1800, formally described the first Venezuelan reptile. Subsequent reports on the herpetofauna emerged from the work of visiting collectors. These were mainly from the United States (see Meek 1910, Burt & Burt 1931), but also included collectors who shipped specimens to the largest museums in Europe during the second half of the 19th century and the early 20th century; specimens were sent to Germany (Peters 1863), Switzerland (Roux 1927), and the United Kingdom (Boulenger 1903). Beginning in the 20th century, more detailed studies by Venezuelan and foreign authors began to appear (e.g., Ernst 1888, Briceño Rossi 1934, Alemán 1953, Rivero, 1961, Roze & Solano 1963), and professional herpetology in Venezuela began to flourish.

The works of Roze (1970: 64–66), Gallardo (1994), Lancini (1996), La Marca (1997a, b), and the compilation of Texera Arnal (2003) represent the first attempts to trace the historical development of herpetology in the country. The latter deals with the development of zoology and its different disciplines in Venezuela from 1936 to 1970—an economically and socially transformative period in which academic herpetology began to develop. The biographical sketch of Pedro Trebbau (1929–2021) and the obituary of Michael Schmidt (1948–2018) reveal previously unknown aspects of such history (Rivas and González 2019, Viloria et al. 2019).

Few Venezuelan zoologists have recorded the history of their disciplines, save for the authors cited above and some others in disciplines other than herpetology (Aguilera 1985, Rodríguez 2006, Lew et al. 2014). As a result, the more recent history of Venezuelan herpetology seems to have been forgotten rather quickly, especially in the areas where professionals and amateurs are scarce. Although the work of Texera Arnal (2003) is seemingly well documented, it lacks critical detail, as the author herself admits.

We present herein a biographical sketch of Juan R. León-Ochoa as a contribution to the knowledge of the development of herpetology in Venezuela. He was a biologist who left a deep impression on our current knowledge of the ecology of the Venezuelan herpetofauna. Juan León is perhaps one of the first Venezuelan herpetologists to have been trained abroad, who also trained young Venezuelan investigators (who are becoming pioneers in their areas), without having been mentioned in the history of national zoology. Other young Venezuelan herpetologists, such as Pedro Durant (1933–2020) and Haydée Solano de Chacín (b. ~1935), were also trained abroad. Durant subsequently specialized in small vertebrates, mainly mammals, whereas Haydée Solano maintained her interest in herpetology, both being the first Venezuelans to describe new species of amphibians for the country. Other notable pioneers are Delia Rada de Martínez (1940–2023) and Carlos Rivero-Blanco (1942–2021).

Juan Ramón León Ochoa was born on November 18, 1937 in Tucupita, the largest town and also the capital of the former Territorio Federal Delta Amacuro (now the state of Delta Amacuro), Venezuela. When he was a child, he and his family moved to Margarita Island (state of Nueva Esparta), probably looking for a better and less parochial life. The historical link between Margarita Island and Tucupita is a long-standing relationship; a group of fishermen from Margarita, led by Juan Millán, first settled at Tucupita in 1848. Juan León finished high school in Margarita and then moved to Cumaná, state of Sucre, to study biology at the Universidad de Oriente (UDO); he received his biology degree on February 12, 1965, with a meritorious Medal of Honor. His undergraduate thesis on embryogenesis of *Pleurodema brachyops* was completed under the guidance of Roberto Donoso-Barros (1921–1975), a Chilean herpetologist who was a zoology professor from 1963–1964 at UDO (Donoso-Barros 1968, Péfaur 1976, Pincheira-Donoso & Núñez 2006). Juan was a member of the first cohort of biology graduates from that university. His class of 1965 was named after the renowned

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Fig. 1. Juan León with his fellow graduates, on the occasion of being awarded his degree in biology from the Universidad de Oriente at Cumaná, Venezuela (1965).

EL NACIONAL – MARTES 8 DE JUNIO DE 1965

Torre de CONTROL

U. LOSSADA RONDON

Maiquetía, 7. — (Especial).

A ESTUDIAR CIENCIAS EN UNIVERSIDAD DE KANSAS

De UDO.

Esta mañana viajan a Estados Unidos cinco profesores de la Universidad de Oriente.

Van con la misión de realizar cursos de *master* en diversas ciencias en la Universidad de Kansas City.

—¿Cuánto tiempo?

—Dos años.

Este viaje forma parte del pacto de ayuda firmado entre las Universidades de Oriente y de Kansas.

—Posteriormente viajarán otros profesores a especializarse.

Los viajeros son: Hernán Córdova, Osman Nuceti, Juan R. León, José J. Chaparro y Rubén Arias.

Podríamos decir que esta gira y las otras que vendrán son producto de la labor fecunda que han desplegado en UDO, Luis Manuel Peñalver, Eduardo González Reyes, José Lorenzo Pérez, Ernesto Jacir y otras personas...

EL 20 LLEGA EL TERCER AVION AVRO PARA LAV

El día 20 (domingo) de este mes llegará el tercer avión Avro de los siete que ha adquirido la Línea Aeropostal Venecolana.

Lo anuncia el doctor Ramón Granadillo apenas pisa tierra, procedente de Guayana.

—Después vendrán cuatro más.

—¿Y el pool con Avensa?

—Siguen las conversaciones.

—¿Es negocio para Aeropostal?

Ramón Granadillo se acomoda la corbata a tiempo que explica:

—Uno no sabe si una cosa es negocio hasta que no la realiza. Mientras tanto, todo se reduce a posibilidades y cálculos.

Y el doctor Granadillo recoge del suelo los espejuelos que se le habían caído...

Ramón Granadillo

Fig. 2. News published on June 8th, 1965 in the Venezuelan newspaper *El Nacional*. The text reports about five graduates of UDO, among them Juan R. León (in the middle), who were to travel to the United States to begin scientific studies at the University of Kansas.

Spanish-Venezuelan medical doctor and politician, Augusto Pi Suñer (Fig. 1).

That same year, Juan, supported by a scholarship provided by an agreement between the Ford Foundation and the UDO (Ford Foundation Annual Report 1965: 66), moved to the USA to study amphibian systematics at the University of Kansas under the mentorship of Dr. William E. Duellman (1930–2022). He obtained his Master's degree in 1968 for his thesis on the taxonomy of Central American frogs of the *Hyla rubra* Group (now in the genus *Scinax*) (Fig. 2). While a student at Kansas, he spent time in the field in Costa Rica with John D. Lynch, Linda Trueb, and other graduate students (León 1969, Duellman 2015).

Once back in Venezuela, Juan won a position as a professor at UDO in Cumaná, where he developed research projects on lizard ecology and amphibian reproductive biology (León-Ochoa & Donoso-Barros 1970, León-Ochoa 1975, León 1977). He oversaw several undergraduate projects in lizard ecology involving mainly teiids and tropidurids, which were common families in the xeric areas surrounding the campus of the university. One of the authors of this note (AP), was among these students and studied the reproduction of the "Guaricongo" (*Tropidurus hispidus* Spix, 1825), a widely distributed species in Venezuela (Prieto 1969, Prieto et al. 1976). As a lecturer and professor, Juan León taught several courses, including General Zoology, Vertebrate Zoology, Herpetology, and Statistics, to both undergraduate and graduate students. These were regular classes at the *Escuela de Ciencias* (School of Sciences) and the *Instituto Oceanográfico de Venezuela* (Oceanographic Institute of Venezuela, IOV). He also directed a number of theses dealing with the reproduction and food habits of fishes (Obando & León 1989, Palazon et al. 1994, Parra Hernández & León 1984). From 1974 to 1980, the Rector of UDO, Luis Manuel Peñalver, appointed him Executive Secretary of the Fellowship Commission for the Professors of the Universidad de Oriente, part of the graduate student and faculty exchange between the University of Kansas and UDO (The program acronym was KU-UDO) (Álvarez 2015).

León's Master's thesis (León 1969) was a pioneering study on the taxonomy of the five species and two subspecies of frogs then recognized within the *Hyla rubra* Group, currently included in the genus *Scinax* (Fig. 5). This study has been rarely cited, possibly because a year later, the monumental work *The Hylid Frogs of Middle America* (Duellman 1970, with an update in 2001 by SSAR) was published, becoming the primary reference for the hylid frogs of this region.

Juan León collaborated with several invited South American and European researchers who visited UDO during the

Fig. 3. William E. Duellman, Linda Trueb, John Simmons and Juan León in La Escalera, Bolívar, Venezuela. Photo courtesy of W. E. Duellman.

1960s and 1970s (Pirlot & León 1965, León et al. 1970, Donoso-Barros & León-Ochoa 1972, Pérez et al. 1975). Also, he joined as host and collaborated with the Kansas researchers Linda Trueb and John Simmons, led by his former advisor William Duellman for field work in Venezuela (Duellman 2015). Their visit to Venezuela was part of an obligatory stop on their legendary trip through Central and South America with a Ford 350 truck with a chassis-mounted camper.

According to unpublished field notes of William E. Duellman in the archives of the Division of Herpetology at the University of Kansas Biodiversity Institute, Duellman and collaborators, including his 4-year-old daughter, arrived at Juan León's house in Cumaná, Venezuela, on July 8, 1974. After enjoying the hospitality of Juan's family for a few days, they later traveled with Juan to Río Sabacual, near Guaraúnos, one of his study sites where he was researching frog reproduction. Upon returning from this site, they went to the Guiana Highlands of Venezuela, crossing the Orinoco River on their way to La Escalera and the Gran Sabana region (Figs. 3 & 4). They went as far as the Brazilian border before turning back. Juan León had been in charge of the logistics for the whole trip and had made all necessary arrangements and necessary paperwork to pass military checkpoints and travel on a road that was still under construction.

"This part of our trip would not have been possible without Juan's careful advance arrangements and his enthusiastic participation, despite the fact that he spent part of the trip hobbling around with his foot in an elastic bandage after he accidentally rolled a large rock on it. He had fractured a metatarsal, but this did not slow him down much at all" (J. Simmons, pers.comm.).

This expedition proved to the North American researchers what a wonderful naturalist Juan was—a keen observer, a tireless collector, and splendid companion in the field. "Juan taught us several collecting techniques including how to locate *Pipa* in muddy puddles by looking for the protrusion on their noses just above the water level, and how to smoke snakes out of hollow trees" (J. Simmons, pers.comm.). They made a splendid collection of amphibians and reptiles from the area which was subsequently studied for many research papers. On their way back to Cumaná, they spent some time at Juan's study site at Río Sabacual, where they collected adult *Pseudis paradoxa* "and their massive tadpoles," and recorded the frog's calls. After their return to Cumaná, the North American researchers continued on to Colombia.

In 1975, while he was executive director of the KU-UDO program, Juan León returned to the University of Kansas for his sabbatical year, working again with William Duellman.

Fig. 4. John Simmons and Juan León collecting tadpoles in La Escalera, Bolívar, Venezuela. Photo courtesy of W. E. Duellman.

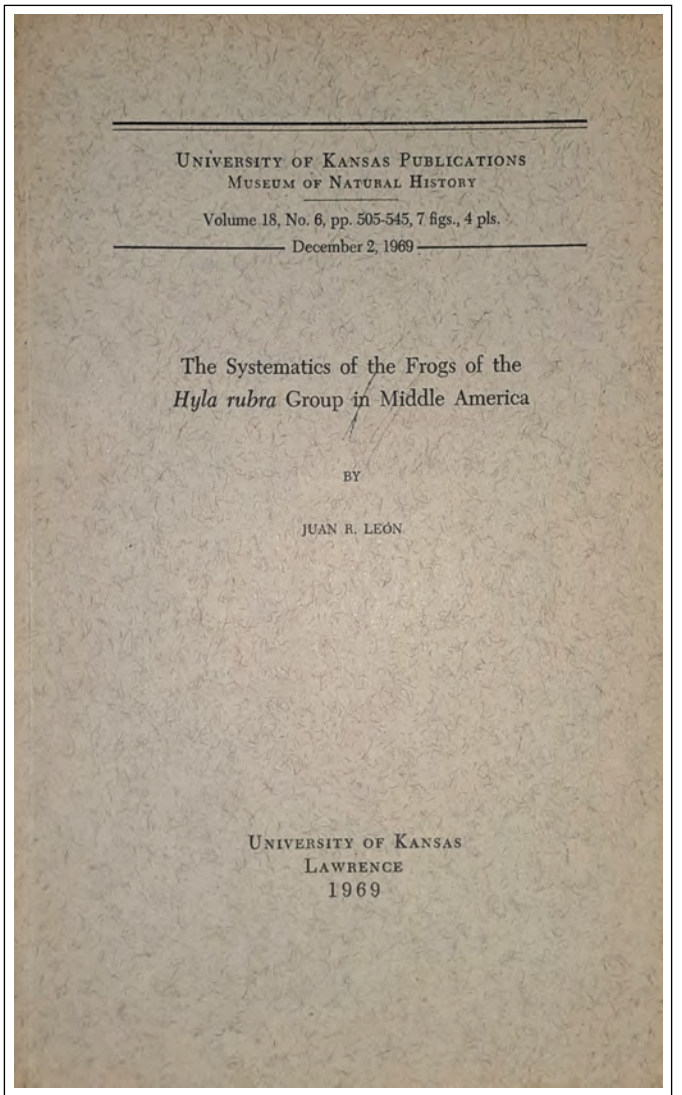

Fig. 5. Cover of "The Systematics of the frogs of the *Hyla rubra* group in Middle America", published in the University of Kansas Publications series (volume 18, No. 6, pp. 505–545, 7 figs., 4 pls, December 2, 1969).

While in Kansas he enrolled in advanced courses in systematics and statistical ecology to update his knowledge on those areas. Upon his return to Venezuela, Juan continued teaching, sharing his newly acquired understanding of the then emerging technique of numerical taxonomy into the biology program of UDO. Juan León continued his research work and advising both undergraduate and postgraduate students in the *Escuela de Ciencias,* and also became a staff member of the *Instituto Oceanográfico de Venezuela* at UDO. The latter institution experienced a boom, with numerous newly enrolled students, increasingly demanding the attention of Professor León for classes and advice on statistical analyses, absorbing most of his academic time. Over the years this situation forced León to drift a little from herpetology, and he dedicated his energy to advise students and to lead research in the area of ecology and reproduction of marine fishes. However, years later the UDO's herpetological studies experienced an increase in the number of publications presented by his students and former students, who always could count on his advice (Oliveros et al. 2000, Cornejo & Prieto 2001, González et al. 2001).

"I remember him as unassuming, quiet, thoughtful, and serious as a student at KU. When I was in the field with him (Costa Rica and Venezuela), I found him dependable, resourceful, and always ready to help. Juan did not thrash his way through the forest, he blended into it—always an observant, quiet, and effective collector. Juan had a sense of humor, deep-seated and easily overlooked. I recall that in Costa Rica …, we had run out of meat; without comment, Juan took off walking down the road and returned with a live chicken; a day or two later, we had a repeat. However, this time he returned with red meat wrapped in a newspaper. He refused to identify it or tell us where it came from. To this day, I suspect it was canine in origin—but I cooked it and we ate it." (L. Trueb, pers.comm.).

For several years, Professor Juan León's time was so occupied with postgraduate studies and teaching, and advising theses in the area of ichthyology, that he did not maintain active academic communication with herpetologists from other regions of Venezuela. He was isolated from the tiny national community of zoologists, who were mostly based in cities of the central and western states of his country. Juan did, however, collaborate with some students and a few foreign colleagues who visited UDO and northeastern Venezuela, among them some graduate students from Kansas, including Stephen R. Edwards. Juan's professional isolation made it very difficult for us to gather information about him. Nevertheless, he was a trail blazer of herpetology in Venezuela.

The contributions of Juan León to the study of reproductive aspects of amphibians and reptiles were, along with those published by Harold Heatwole, Juan Rivero, and Frederick H. Test, among the first of their kind ever carried out in Venezuela. They were followed by studies undertaken by his several students, who went to work at other Venezuelan institutions and stand out as a generation of specialists in different as-

pects of the biology of reptiles, mainly the ecology of lizards (León & Ruiz 1971, León & Cova 1973, Prieto et al. 1976, González et al. 2001, Figueras et al. 2008). Even though studies on different aspects of the natural history of lizards have also been published by researchers and students from other Venezuelan universities, such as the Universidad Central de Venezuela (Caracas), and to a lesser extent, Universidad de Los Andes (Mérida), the Universidad Simón Bolívar (Caracas), and the Universidad del Zulia (Maracaibo), Juan León's influence doubtless is why, during the second half of the 20th and beginning 21th Centuries in Venezuela, the Universidad de Oriente has probably produced most theses in ecological herpetology.

In his daily life, Juan León was passionate about baseball, a sport that he practiced from his early days as an undergraduate student in the incipient *Núcleo de Sucre* of the Universidad de Oriente. He was second baseman and shortstop on his baseball team. He continued to play on weekends in Cumaná after returning from his sabbatical leave. In addition, he always assisted with the organization and planning of sports for children and relatives of the teachers and employees of the UDO Nucleus of Sucre, where he stood out for his knowledge and enthusiasm.

Juan León retired after 30 years of service in the Department of Biology. He remained active for some time after that, despite the progressive effects of Parkinson's disease, which finally led to his demise on January 19, 2016. His passing was the occasion of widespread and great sadness within the entire community of the UDO's Department of Biology. Juan is survived by his wife, Aurelia León, and four children, Junelia Rosa, Juan Ramón, Luis Ramón, and Juan Carlos.

Acknowledgments

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João Joaquim Pizarro (1842–1906), the first Brazilian to publish on anuran amphibians

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Abstract. The contribution of João Joaquim Pizarro (1842–1906), the first Brazilian to publish on anuran amphibians, is analysed. Working at the Museu Nacional, Rio de Janeiro, Brazil, in 1876 Pizarro published "De um pequeno animal extremamente curioso e denominado *Batrachychthis*" [On an extremely curious little animal named *Batrachychthys*], looking for to defend the "doctrine of transformism, so ably sustained by professor Darwin." The genus name *Batrachychthys* Pizarro, 1876, published without association to a species name, was based on a tadpole (deposited in the Museu Nacional, Rio de Janeiro, MNRJ 76) from Potrero Pires (Paraguay). Currently, *Batrachychthys* Pizarro, 1876 is synonymized with *Pseudis* Wagler, 1830 and, since *Pseudis platensis* Gallardo, 1961 is considered a full species, the tadpole described as *Batrachychthys* belongs to this taxon.

Key words: Amphibia, Anura, *Pseudis*, *Pseudis platensis*, synonymy.

The National Museum in Rio de Janeiro

On June 6, 1818, the King D. João VI enacted an edict creating the Royal Museum in Rio de Janeiro, "aiming to propagate the knowledge and study of the natural sciences in the Reign of Brazil …" The incipient collections were composed by a few birds' skins, a good mineralogical assemblage (the Werner Collection), and some pictures (Lacerda, 1905). After the independence of Brazil from Portugal on September 7, 1822, and the establishment of the Empire of Brazil, the institution changed its name to th Imperial Museum. Subsequently, after the proclamation of the republic in Brazil on November 15, 1889, the name changed again to National Museum, as it is currently known.

In its first years, the Royal Museum was merely collection of disconnected materials, much like the old "cabinets of curiosities," housed in a relatively small building, at the central region of the city of Rio de Janeiro (Fig. 1). Although several travelers and collectors came and went from Brazil, sometimes with extensive collections of zoological and botanical specimens, nothing was deposited in the museum. This situation started to change in the Imperial Museum, especially under the government of the Emperor D. Pedro II (1825–1891), through the constitution of a body of scientists associated with the institution. The collections developed, particularly in the botanical, geological, and mineralogical areas. The zoological collections, however, had slower development since few zoologists were hired. As for the herpetological collections, few specimens were assembled, mainly for exhibition purposes.

Despite the existence of a National Museum in Brazil since 1818, the development of the Brazilian herpetology was delayed. European naturalist travelers in Brazil collected extensively throughout the country (Rocha, 2022) and usually returned to Europe from the Rio de Janeiro harbour. Abundant zoological, botanical, and anthropological material was taken along with these travelers, but very few specimens were deposited in the National Museum.

Regarding vertebrates, some dry skins of birds and mammals were deposited, but specimens of amphibians, reptiles, or even fishes, requiring liquid preservation, were rare. In fact, the amphibians collection of the National Museum wasn't established until the 1870's. There was no scientist professionally working on amphibians in the National Museum until Alípio de Miranda-Ribeiro (1874–1939; for his biography, see Travassos, 1955; Pombal, 2002; Adler, 2014).

Alípio de Miranda-Ribeiro was appointed curator of the late First Section (Zoology) of the National Museum on October 27, 1894, at 20 years old, and he was made a Naturalist on 16 August 1897, at 23 years old. His first publication on amphibians didn't appear until 1909. Eleven years later, in 1920 he returned to this subject. In 1937 his last work on amphibians was published, completing a series of 26 contributions. Alípio de Miranda Ribeiro died in Rio de Janeiro on January 8, 1939, at 65 years old, still in zoological research.

The National Museum was transferred to the building that formerly served as the residence of the Real and Imperial families, located in Quinta da Boa Vista, in 1892 (Lacerda, 1905).

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The First Brazilian to Publish on Anuran Amphibians

Although Alípio de Miranda-Ribeiro may have been the first vertebrate's zoologist to work at the Museu Nacional, the first scientific publication on an anuran written by a Brazilian scientist was that of João Joaquim Pizarro, in 1876, through the description of his *Batrachychthys*.

João Joaquim Pizarro (Fig. 2) was born in the City of Rio de Janeiro, Brazil, on February 25, 1842. Nothing is known about his childhood and adolescence, but as was common during that time, he pursued the most prestigious career from then on, Medicine. He presented his first doctoral thesis in 1866, at the Medical College of Rio de Janeiro, titled "*Das feridas por armas de fogo. – (Secção accessoria). Estudo chimico e pharmacologico dos alcaloides das strychneas. – (Secção cirurgica). Dos tumores erecteis do craneo. – (Secção medica). Diagnostico differencial entre a pneumonia e a pleurisia.*" (freely translated from old Portuguese, "*On gunshot wounds. – (Accessory section). Chemical and pharmacological study of the alkaloids of the strychnines. – (Surgical section). Of the erectile tumors of the cranium. – (Medical section). Differential diagnosis between pneumonia and pleurisy*".) In 1872, now respected professional, he defended his second doctoral thesis, at the same College, titled "*Solanaceas brasileiras. – Producção e propagação dos sons. – Altura dos sons. Theoria physica da musica. – Timbre dos sons. Funcção da voz e da palavra. – Ouvido. Sua applicação ao diagnostico.*" (freely translated from old Portuguese, "*Brazilian Solanaceae. – Production and propagation of sounds. – Sounds height. Physical theory of music. – Timbre of sounds. Function of the voice and of the words. – Ear. Its application to diagnosis*").

It must be understood that, during the 19th century, scientific careers were poorly defined, so Natural History, one of the basic objectives of research in the Museu Nacional do Rio de Janeiro, was practiced by physicians. Medicine, in turn, also had disciplines more connected to Natural History than to proper medical practice, such as Botany, Mineralogy, and Zoology. Therefore, in 1866 the directorship of the Museu Nacional was take on by the Counselor Francisco Freire Allemão Cysneiros (1797–1874), a physician and eminent botanist who taught this this subject in the Medical College for several years. His assistant, Dr. Ladisláu de Souza Mello e Netto (1838–1894), however, was the one who actually charted the institutions course. By his initiative, public conferences began in the Museu Nacional in 1866, which were announced in newspapers and well attended, including with the presence of the Emperor D. Pedro II and his ministers. Dr. Pizarro participated of these meetings as lecturer, alongside several scientific personalities from the Museu Nacional and of invited foreign scientists.

Fig. 1. Museu Real, after Museu Imperial and Museu Nacional. First building, in the central region of the City of Rio de Janeiro, Brazil. Avulse sheet inserted in Ladisláu-Netto (1870).

By a decree on November 22, 1871, Dr. João Joaquim Pizarro was named Director of the Section of Zoology and Comparative Anatomy, replacing Dr. Manoel Ferreira Lagos (1816–1871), who had recently died. Thus, Dr. Pizarro definitively entered the administration of the Museu Nacional, also assuming the roles of Secretary and Librarian by designation in an ordinance from January 4, 1872. He left the role of Librarian on February 11, 1876, and of Secretary on December 31, 1878.

By the Decree nº 6116, dated February 9, 1876, the Museu Nacional was administratively reorganized and, among several provisions, the new statute mandated the publication, at least quarterly, of a journal titled "*Archivo* [sic] *do Museu Nacional*" (currently *Arquivos do Museu Nacional*). Another decree, published on the same date, appointed Dr. Ladisláu Netto as the General Director of the Museu Nacional and Dr. João Joaquim Pizarro as the Director of the First Section, "*De Anthropologia, Zoologia Geral e Applicada, Anatomia Comparada e Paleontologia Animal*" (freely translated from old Portuguese as "*Of Anthropology, General and Applied Zoology, Compared Anatomy and Animal Paleontology*"). Additionally, through an ordinance from the General Director, Dr. Pizarro's designation as Secretary of the Museu Nacional was confirmed.

João Joaquim Pizarro continued as a professor at the Medical College of Rio de Janeiro where he taught Botany and Medical Zoology in 1882. In the Museu Nacional, he conducted a "Course in Zoology", which included a discussion of "the history of animals, the study of classification, and the anatomical and physiological characters which were the indicators of differences in taxonomic contexts" (Sá & Domingues, 1996). However, to comply with the rules of incompatibility, he was compelled to retire from the position of Director of the 1st. Section of the Museu Nacional on April 17, 1883. Furthermore, on November 19, 1883 a ministerial communication officially removed him from that position. Meanwhile, as a physician and Official of the Order of the Rose, Dr. J.J. Pizarro was appointed Director of the Asylum of the Helpless Children (created by a decree dated August 24, 1874), a role he held from 1879 to 1888. Additionally,

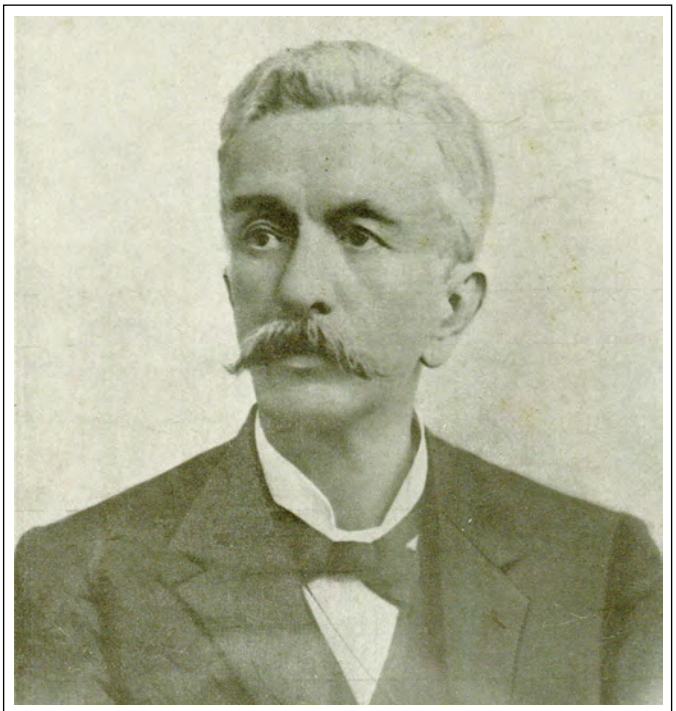

Fig. 2. João Joaquim Pizarro (1842–1906).

on February 25, 1883, Dr. Pizarro participated, together with 15 other members of the Imperial Court, as mastermind and founder of the Society of Geography of Rio de Janeiro (which, in 1945, became the Brazilian Society of Geography). Finally, after all this, J.J. Pizarro was appointed Director of the Botanical Garden of Rio de Janeiro in the period from 1902 to 1903. He died few years later in Rio de Janeiro, on February 21, 1906, at the age of 64 (Anonymous, 1906; Lacerda, 1905).

The *Batrachychthys*

Signing simply "Dr. Pizarro", his paper entitled "*Nota descriptiva de um pequeno animal extremamente curioso e denominado* Batrachychthys" (freely translated from old Portuguese, "*Descriptive note on an extremely curious little animal named* Batrachychthys") (see Appendix) appears in the first volume of the then recently created "*Archivos do Museu Nacional*", in 1876. In this lengthy note, Pizarro seeks to defend the "*doctrina do transformismo, tão habilmente sustentada pelo professor Darwin, já prevista e aceita por não pequeno número de naturalistas antigos, e ha, pouco mais de meio seculo logicamente apresentada ao mundo scientifico por Lamarck, tem se constituido com o desenvolvimento á ella dado pelo naturalista inglez, o assumpto das meditações e pesquizas dos sabios de nossos dias*" [*doctrine of transformism, so ably sustained by professor Darwin, already foreseen and accepted by not small number of ancient naturalists, and logically presented to the scientific world a little more than half a century ago by Lamarck, has become, with the development given to by the English naturalist, the subject of the meditations and research of the wise men of our days*] .

His specimen comes from "*Potrero-Pires no Paraguay que, como se sabe, está em região inhospita e talvez nunca visitada por naturalista algum*" [*Potrero-Pires in Paraguay which, as is known, is in an inhospitable region and maybe never visited by any naturalist*"]. The paper provides a very detailed description of the specimen, which is also illustrated (see Appendix). The type specimen of *Batrachychthys* is currently deposited in the Museu Nacional, Rio de Janeiro (MNRJ 76; 91.6 mm in total length; Fig. 3).

The intention of the author was to demonstrate that this "frog-fish" (whence *Batrachychthys*, from the Greek *batrachos*, frog + Greek *ichthys*, fish; Lavilla *et al.*, 2022) could be the intermediary element between these two animals, but "*é verdade que os orgães sexuaes poderiam affirmar a fixidade da especie e participando ella de fórmas tão distintas se constituiria um élo da cadeia que liga a classe dos peixes á dos batrachios. Mas, por não ter eu reconhecido o caracteristico dos sexos em razão das difficuldades de observação, não se segue que seja este argumento erigido como a unica arma talvez contra a opinião que bem se póde levantar de ser elle um animal, que, como alguns outros, apresenta caracteristicos de classes distinctas e que se constituem prados como argumentos de grande valor pelos sectarios da doctrina evolutiva*" [*it is true that the sexual organs could assert the fixity of the species, and belonging to such distinct forms would constitute a link in the chain which connect the class of the fishes with that of the batrachians. But as I have not recognized the sex on account of the difficulties of observation, it does not follow that this argument is the only weapon against the opinion which may be raised in being an animal, which, like some others, presents characteristics of distinct classes, and which constitute arguments of great value by the followers of the doctrine of evolution*"*i*].

It is noteworth that Pizarro, shortly after the publication of the "*On the Origin of the Species*" by Darwin (1859) and living in a conservative society in Rio de Janeiro, had embraced the theory of evolution and made efforts to disseminate it. According to Dr. João Baptista de Lacerda (who succeeded J.J. Pizarro in the administrative position of Director of the 1a. Section of the Museu Nacional) in *Fastos do Museu Nacional do Rio de Janeiro* published in 1905, Pizarro was more of a good lecturer than a technical professor. Moreover, Lacerda (1905) reported that "*com seu radicalismo transformista exaggerado elle escandalisou, mais de uma vez, o auditorio feminino, frisando as linhas e os pontos de contacto que existem entre o homem e o macaco*" [*by his exaggerated transformist radicalism he scandalized, more than one time, the feminine audience, stressing the lines and contact points which exist between the man and the ape*], continuing "*comprovando-se assim, ainda uma vez, a impossibilidade de reconciliar-se a sciencia com a vaidade feminina e com os preconceitos humanos*" [*proving, once again, the impossibility of reconciling science with feminine vanity and human prejudices*].

However, the publication on *Batrachychthys* by Pizarro (1876) was not well received. Alípio de Miranda-Ribeiro, in his "*2. Conferencia - O Museu Nacional segundo dados officiaes e officiosos*" [*2. Conference – The National Museum according to official and unofficial data*], presented and published in 1920 as part of a lecture series on the "*A Commissão Rondon e o Museu Nacional*" [*The Rondon Commission and the National Museum*], utilized Pizzaro's publication as example to attack the competence of the researchers of the Museu Nacional in the past: "*Aqui está o primeiro volume dos Archivos pag. 31. Aqui está este celebre artigo que tem me cabido explicar á estrangeiros que d'elle me fallam com sorrisos sub-linhados: — Nota descriptiva de um pequeno animal extremamente curioso e denominado batrachychthis. — Aqui estão as figuras; aqui o animal que servio para a descripção e figura: É um gyrino ou larva de rã* — Pseudis paradoxa*, justamente caracterisadas porque os seus gyrinos são do tamanho do animal perfeito. Pois bem, este artigo pretende mostrar um animal intermediario entre o sapo e o peixe, com que o auctor — cujo nome não nos interessa revellar, chamou a atenção de Darwin, Haeckel e Charles Martin ...*" [*Here is the first volume of the Archivos pag. 31. Here is this famous paper that I had to explain to foreigners that speak about it with underlined smiles: — Descriptive note on a little animal extremely curious and denominated batrachychthis [*sic*]. — Here are the figures; here the specimen that served to the description and figure: it is a tadpole or frog larvae* – Pseudis paradoxa*, precisely characterized because its tadpoles are by the size of the perfect animal. Well, this article intends to show an intermediary animal between the frog and the fish, by what the author – whose name do not interest us to reveal, called the attention of Darwin, Haeckel and Charles Martin ...*]. Miranda-Ribeiro (1920a) returned to this theme in his *3. Conferencia – O que os governos fazem do Museu; – o que elle deve ser, – a licção de Rondon* [*3. Conference. What the governments make of the Museu; – what it must be, – the lesson of Rondon*], where he exemplified mistakes made by scientists, among them citing: "*... houve aqui quem elevasse uma larva de sapo á altura d'uma fórma nova ...*"[*... there was one who elevated a frog larva to the level of a new form ...*].

As far as we know, the note on the *Batrachychthys* was the only scientific paper published by J.J. Pizarro during his long academic life.

According to Caramaschi & Cruz (1998), in the description of *Pseudis fusca* by Garman (1883) the specimens studied were considered representatives of adult specimens of *Batrachichthys* [sic] *pizarronis*, without further comment. Thus, Garman (1883) created a *nomen nudum* (see ICZN, 1999) associated to *Pseudis fusca* (Caramaschi & Cruz, 1998; Lavilla *et al.*, 2022; Frost, 2023). The genus name *Batrachychthys* Pizarro, 1876, published without association to a species name and based on a tadpole, is currently synonymized with *Pseudis* Wagler, 1830 (Garman, 1877; Frost, 2023). Since *Pseudis platensis* Gallardo, 1961 is considered a full species (Aguiar *et al.*, 2007; Frost, 2023), the tadpole described by Pizarro (1876) as *Batrachychthys* belongs to this taxon.

Fig. 3. *Batrachychthys* Pizarro, 1876: dorsal, lateral, and ventral views of the type-specimen deposited in Museu Nacional, Rio de Janeiro (MNRJ 76; 91.6 mm in total length).

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Appendix

Facsimile of Pizarro [J. J.] 1876. Nota descriptiva de um pequeno animal extremamente curioso e denominado *Batrachychthys*. *Archivos do Museu Nacional* 1: 31–35, pl. 6.

NOTA DESCRIPTIVA

De um pequeno animal extremamente curioso e denominado BATRACHYCHTHIS

PELO

DR. PIZARRO

A doctrina do transformismo, tão habilmente sustentada pelo professor Darwin, já prevista e aceita por não pequeno numero de naturalistas antigos, e ha, pouco mais de meio seculo logicamente apresentada ao mundo scientifico por Lamarck, tem se constituido com o desenvolvimento á ella dado pelo naturalista inglez, o assumpto das meditações e pesquizas dos sabios de nossos dias. Generalisada por alguns espiritos ousados tem-se procurado dar-lhe uma tal latitude que certo não comportam ainda os nossos conhecimentos actuaes. Estabelecida depois de longo e afanoso trabalhar em objectos de pura observação e experiencia, repetidas e multiplicadas pelo genio indagador de notaveis collaboradores, parece achar esta theoria apoio no movimento intellectual, que ao nosso seculo têm imprimido os conhecimentos hodiernos.

O genio reformador que caracterisa a nossa época, trazendo a liberdade do pensamento, favorece a expansão das intelligencias ; e não admira pois que um grande numero de sectarios da doctrina evolutiva se vá apresentando por toda a parte.

O bom caminho e o progressivo desenvolvimento que começa a ter no Brazil o estudo das sciencias naturaes, graças á paternal solicitude do seu Imperante, póde-se dizer que é em boa parte devido ao impulso grandioso que ao movimento scientifico deste paiz deu o genio de Darwin com a publicação do seu trabalho

sobre *a Origem das especies*. Verdadeiro monumento de paciencia e de genio veio este livro despertar a attenção dos povos do continente sul-americano cujos filhos pareciam dormir o somno da indifferença sobre o mundo de preciosidades que enthesouram as suas terras.

No Brazil, cuja flora e fauna ostentam um vigor e magestade talvez sem rival no mundo, só ha pouco começou á ser roteado pelos seus filhos o campo fertilissimo dos estudos da historia natural. O Museu Nacional do Rio de Janeiro, si bem que ainda acanhado, é o theatro de acção das investigações de alguns brazileiros que, amantes de sua terra, procuram contribuir para a felicidade d'ella, entregando-se com ardôr ao cultivo da historia natural.

Conhecida por alguns raros naturalistas estrangeiros, começa esta instituição á caminhar com passo seguro na senda do progresso e póde-se assegurar que, em pouco tempo, virá este nucleo de nuturalistas, aliados aos seus irmãos d'além mar, produzir trabalhos que honrem a magestade da terra que os vio nascer. Do Brazil estou certo, pelas riquezas que encerra, poderá nascer o germem das convicções que ás doctrinas modernas querem imprimir os naturalistas europeus. Na sua fauna erpetologica, tão pouco estudada e conhecida, encontra-se um sem numero de especies não classificadas e que bem poderiam ser o alvo das attenções dos zoologistas brazileiros. As collecções de ophidios e batrachios que possue o Museu não tem sido ainda convenientemente estudadas para que dellas se possa dar noticia segura.

Na qualidade porém de Director da secção de Zoologia e Anatomia comparada deste estabelecimento, e encarregado de um curso destas sciencias, tenho-me empenhado em reformar a classificação e adaptal-a ás necessidades do ensino. Neste serviço deparei, entre outros objectos dignos de nota, com um exemplar de um pequeno animal, que para logo chamou a minha attenção em razão da sua conformação singular.

Na impossibilidade de intentar sobre elle um estudo serio e minucioso como desejava, por possuir só uma amostra que não posso sacrificar ás exigencias de uma boa dissecção, faço a succinta descripção que entrego ao mundo sabio sem grandes commentarios, acompanhada de tres photographias que representam o animal em posições diversas [1].

Reservo-me, todavia para mais tarde, os estudos anatomicos que a particularidade da sua fórma reclama, e tomo desde já a liberdade de offerecer esta succinta nota á attenção dos professores Darwin, Hœckel e Charles Martins dos quaes me desvaneço em ser humilde admirador.

Tracta-se de um pequeno animal que vive nas lagôas e aguas estagnadas, que raramente pode ser visto em razão da timidez que lhe é peculiar, furtando-se facilmente aos olhos dos rarissimos viajores que por certos logares invios e incultos do Brazil tem passado. O exemplar que possue o Museu foi remettido do Potrero-Pires

[1] Vide a *Estampa VI.*

no Paraguay que, como se sabe, está em região *inhospita* e talvez nunca visitada *por naturalista* algum.

Consta-me que os ha tambem em certos lugares do grande rio Amazonas onde a fraca correnteza, constituindo remansos, fórma especies de lagôas sem limites e onde as aguas se não renovam. Os habitantes dos logares proximos, que informam ser este animal raro, chamam-n'o *sapo-peixe* em virtude de sua singularissima conformação exterior.

Assemelha-se realmente e muito á um sapo no terço anterior de seu corpo, e á peixe nos dous terços posteriores. Além disso, sahindo algumas vezes de sua morada habitual, este pequeno animal, saltitando como um perfeito batrachio á favor das quatro patas que possue, atravessa distancias não pequenas para entrar novamente n'agua.

É um animal de 14 centimetros de comprimento no diametro antero-posterior, de côr amarello-escura e apresentando estrias regulares nos dous terços posteriores do corpo: é alongado, achatado transversalmente e offerece um sulco longitudinal no meio de cada uma das faces lateraes. Em razão do contraste apparente do terço anterior com os dous terços posteriores, elle se divide naturalmente em duas partes distinctas. A parte anterior, que forma o terço anterior, do animal, é constituida pela cabeça, thorax e abdomen; tem a fórma irregularmente triangular vista de lado, correspondendo o apice do trianguto, que é rhombo ao orificio bucal.

Toda esta parte se acha envolvida, á guisa de um collete, por uma membrana espessa e resistente de côr escura que a cobre por todos os lados e se adianta em fórma de natatoria ventral adherente á face ou antes ao bordo inferior de todo o corpo do animal á terminar no extremo caudal. Por aberturas nella existentes lhe sahem as quatro patas, sendo as duas anteriores muito menores do que as posteriores e munidas de quatro appendices digitaes livres; as posteriores, fortes e musculosas são providas de cinco dedos ligados por uma membrana interdigital delgada mas resistente. Esta tunica que envolve completamente o seu terço anterior é fortemente adherente ao corpo de modo a não poder ser delle destacada e envia igualmente um prolongamento que, se fixando ao bordo superior do resto do corpo, vai como o inferior formar a natatoria dorsal que se termina igualmente na cauda.

A um centimetro do orificio bucal de cada lado notam-se olhos do animal; mais á baixo e para traz, justamente no rebordo anterior do annel por onde emergem as duas patas anteriores observam-se de ambos os lados duas pequenas porções de um tecido esponjoso (restos das branchias) e que cobrem os orificios que conduzem aos pulmões, já perfeitamente desenvolvidas na épocha da vida em que o observamos.

No rebordo interior da boca, que tem meio centimetro de largura, nota-se com o auxilio de uma lente, quatro pequenas eminencias allongadas, duas no maxillar superior e duas no inferior, eminencias asperas que muito se assemelham ás que se encontram no genero *Galeichtys*, peixe conhecido vulgarmente pela denominação

de *Cambuatá* e cujos habitos e aspecto exterior são realmente singulares e tem toda a analogia com o animal em questão.

Os dous terços posteriores do corpo são constituidos por uma massa espessa de tecido muscular, contido em especies de compartimentos rectangulares formados por uma membrana delgada que, partindo dos bordos superior e inferior do corpo vai terminar no meio de cada uma das faces, precisamente na parte correspondente ao sulco que se vê do lado exterior. Esta massa de tecido muscular é completamente adherente e intimamente ligada á parte anterior, e apresenta no bordo superior envolvido pelas fibras musculares um tubo cartilaginoso e espesso que, fazendo continuação a ultima vertebra, vem terminar insensivelmente no extremo do corpo.

Por uma incisão longitudinal que fiz na face inferior do ventre pude observar a disposição dos intestinos, que são ennovellados, entortilhados de fórma á parecer uma rodilha cujas voltas se sobrepõem umas ás outras, justamente com a disposição que affectam os intestinos do *Galeicthys bahiensis* (Castelnau).

Nada pude observar com relação aos orgãos sexuaes, que á serem vistos, não deixariam duvida em meu espirito á respeito do seu lugar taxonomico.

Sem um estudo anatomico mais circumstanciado e na deficiencia de outros esclarecimentos indispensaveis, nada de positivo posso realmente dizer; mas julgo que é de alguma importancia esta nota que deve ficar registrada á espera dos ulteriores desenvolvimentos que lhe podem trazer os naturalistas que tiverem a felicidade de possuir outros exemplares, ou que os possam observar nos logares em que elles habitualmente vivem.

A primeira vista parece ser este animal um *gyrino* (têtard) em periodo de evolução anterior ao seu completo desenvolvimento, que depois de experimentar as ultimas metamorphoses proprias á esta classe de animaes deve originar um batrachio de proporções relativamente collossaes.

Algumas considerações comtudo surgem e apresentam-se ao espirito do observador que são outras tantas duvidas que convem sejam dissipadas para se poder elle assentar em juizo definitivo. Se é este animal uma fórma transitoria, admira realmente que não tenha sido até agora encontrado em pleno vigor de existencia e nos logares o animal perfeito de que o actual é o exordio.

Além disso é sabido que os gyrinos (têtards) são animaes pequenos cuja transformação opera-se lenta e gradualmente, mas de modo tal que, ao desenvolvimento de um orgão que tem de permanecer, corresponde ordinariamente a atrophia do que é imprestavel; assim vê-se que a cauda dos gyrinos, que lhes serve exclusivamente para a vida aquatica, vai-se atrophiando até desapparecer, á proporção que apparecem as patas posteriores e anteriores, e as branchias se mudam em pulmões, exactamente na épocha em que, o animal já provido de orgãos para a locomoção e podendo respirar em outro elemento, abandona as aguas e vem á viver na atmosphera.

Não é porém o que acontece com o meu *Batrachychthys* cuja supposta cauda é

constituida pela porção carnosa que forma os dous terços ou antes os tres quartos posteriores do animal e que tem nada menos do nove centimetros de comprimento, medindo apenas cinco centimetros a parte anterior ou a mais importante na hypothese de ser um gyrino. Esta camada muscular é extremamente espessa e volumosa: por isso muito difficil o é tambem suppôr-se que se possa operar uma reducção e o desapparecimento completo dessa porção carnosa em proveito de uma parte relativamente pequena: seria o sacrificio de quasi o todo pela parte; o que parece repugnar á norma reguladora das compensações com que a natureza equilibra a vida no organismo animal.

Des que o animal possue na idade que o observamos, pulmões perfeitamente desenvolvidos prestando-se á respiração aéria, e é dotado de orgãos locomoveis tão fortes, não sei porque esperar-se pela atrophia de quasi o corpo inteiro, só com o fim de accomodarem-se os factos naturaes ás theorias preestabelecidas á favor das quaes tudo se pretende enquadrar em circulo de ferro.

É verdade que os orgães sexuaes poderiam affirmar a fixidade da especie e participando ella de fórmas tão distinctas se constituiria um élo da cadeia que liga a classe dos peixes á dos batrachios. Mas, por não ter eu reconhecido o caracteristico dos sexos em razão das difficuldades da observação, não se segue que seja este argumento erigido como a unica arma talvez contra a opinião que bem se póde levantar de ser elle um animal, que, como alguns outros, apresenta caracteristicos de classes distinctas e que se constituem prados como argumentos de grande valor pelos sectarios da doctrina evolutiva.

Dir-se-me-ha ainda que talvez este já está animal no periodo transitorio daquelles batrachios que permanecem dous e mais annos em estado de gyrino e que afinal experimentando a ultima metamorphose se constituem batrachios perfeitos.

N'este casos porém o ultimo termo da evolução natural guarda perfeita relação com as phases anteriores, isto é a um gyrino relativamente grande que se vai pouco á pouco desenvolvendo, succede um batrachio tambem proporcionalmente grande. A lei das correlações de fórma e grandeza não é desmentida.

São estas as considerações que julguei conveniente registrar n'esta nota e que a occasião me leva a offerecer ao esclarecido criterio dos sabios, promettendo-lhes dar quando me fôr possivel o complemento ou o resultado final dos estudos que neste sentido tenho iniciado.

Possa esta curta noticia merecer dos naturalistas a sua attenção que me sentirei feliz, e com o ser-lhes summamente agradecido asseguro ao mesmo tempo qualquer que seja a sua opinião a este respeito será ella para minha o estimulo para outros estudos.

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BATRACHYCHTHYS

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On the Provenance of the two large Gharials in the Display Collection of the Natural History Museum Vienna*

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Abstract. While exhibits in natural history museums have great value as display and teaching objects, they can also have a provenance that is fascinating and enlightening. One such example is the two, large gharial (*Gavialis gangeticus*) hides exhibited in the Natural History Museum Vienna. They were purchased in 1902 by Franz Steindachner, the then Intendant (Director), and impress with their enormous size of 453 cm and 543 cm, respectively. Although they have been in the museum's collections for 120 years, until recently very little was known about the origin of the two crocodiles and how they originally came to Vienna. During our provenance research, we were able to reconstruct considerable aspects of the path of the two unique specimens from South Asia via the famous animal trader Carl Hagenbeck and the Umlauff family business in Hamburg, Germany, to the Austrian capital. In addition, other large gharial specimens in European natural history museums from Umlauff are discussed and illustrated herein.

Key words: Provenance research, Natural History Museum Vienna, Carl Hagenbeck, Johannes Umlauff, trade in natural history items.

On the Importance of Exhibits in Natural History Museums

Exhibits in natural history museums can be divided into two categories: those that represent an animal or plant species — i.e., that function as an arbitrary example of a certain species — and those that also have a special characteristic, an individual history and provenance that makes them unique. While the latter specimens represent the vast majority of the scientific collections of natural history museums, most are not open to the public. In the best cases they have precise information on origin such as place of discovery, date, and collector's name. However, these data, which are essential for research, may be missing in the case of purely exhibition objects. Sometimes display items are not even real specimens of a species, but only (more or less) naturalistic casts or replicas, although they do nevertheless serve their representative purpose. In unfavorable cases, as often happened in the early days of natural history museums, the precise provenance information about an individual was lost on its way from nature to a museum collection. A scientific specimen is thus degraded to a mere display object. Here we attempt to reconstruct, as far as possible, the individual history of two large Indian gharials at the Natural History Museum Vienna (NHMW), a history which was largely unknown for over 120 years. In this way we hope to help them to achieve a higher scientific value.

The Indian Gharial – an Unusual Crocodile Species

Within the crocodiles (Crocodylia), the Indian Gharial or Gavial (*Gavialis gangeticus*) and the False or Sunda Gharial (*Tomistoma schlegelii*) are the only representatives of the family Gavialidae still living today (Willis et al. 2007, Oaks 2011). The species *G. gangeticus* was first scientifically described in 1789 by the Göttingen scholar Johann Friedrich Gmelin (1748–1804) in what he called the 13th edition of Carl von Linné's (1707–1778) "Systema Naturae". On the Indian subcontinent, this crocodile species is now only found in a few fragmented areas of the river systems of northern India and the Nepalese plains. Historically, gharials have inhabited major rivers from the Indus in Pakistan to the Ganges and Brahmaputra in Bhutan and Bangladesh, and possibly as far as the Irrawaddy in Myanmar. With an estimated population of less than 1000 reproductive individuals in the wild, the gharial is considered critically endangered by the IUCN (Lang et al. 2019). In addition to habitat destruction and alteration through dams and drainage, toxins, and contamination of the water bodies as well as persecution by humans are responsible for the acute threatened status of the species. Thanks to targeted conservation efforts, the population decline has been halted for several years and populations are slowly increasing again (Acharya et al. 2017). With their characteristic, strongly elongated snout and long, pointed teeth, gharials are primarily fish

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Fig. 1. The two large Indian gharials in Hall 28 of the Natural History Museum Vienna are among the most impressive exhibits in the reptile and amphibian exhibition. Very little was known about their origin until now. Photo: Alice Schumacher.

eaters. They are also the only crocodiles that show visible sexual dimorphism. The males have a bulbous thickening on the tip of their snout, which acts as a resonating body when they exhale in an impulsive manner and thus plays a role in intraspecific communication. This structure of the males is named after the North Indian word for a clay pot, ghara. The name of the animals themselves is also derived from this word. Griffith et al. (2023) call the Indian Gharial "the most functionally distinct crocodylian" because of its peculiarities.

The large Gharials in the Natural History Museum Vienna

The two gharials in Hall 28 of the NHMW are among the largest exhibits of this unique crocodile species worldwide (Figs. 1 and 2). Consequently, they are also listed among the "TOP 100" exhibition objects of the Natural History Museum (Ott et al. 2012: 171) and were mentioned 100 years earlier in "Brehms Tierleben", whose volume on amphibians and reptiles was edited by Franz Werner (1867–1939), the well-known zoologist of the University of Vienna (Werner 1912). On the occasion of the second visit of the Emperor Franz Joseph I (1830–1916) to the "Naturhistorisches Hofmuseum" on 28 February 1905, Franz Steindachner (1834–1919), the Intendant (Director) of the Museum, wrote in his annual report that "the occasion (...) was the inspection of some important recent acquisitions of the Hof Museum." Thus, after the ceremonial reception of the emperor, the first place visited was the octagon on the first floor, where the latest "ethnographic and other collection results (...) were put on temporary display. Afterwards, the large group of gharials, a gift from the court counsellor Steindachner, was also viewed" (Steindachner 1906).

The female is 453 cm long. The male, which has the characteristic bulge on the tip of its snout, measures 543 cm. Originally, both crocodiles were reported to be 420 cm and 530 cm long, respectively, but a measurement taken during the cleaning of their display case in June 2011 revealed a significantly greater total length, especially for the female. The two specimens bear the inventory numbers NHMW 32226 (male) and NHMW 32227 (female). The origin is only vaguely noted as "British India", the former British colonial empire of the Indian subcontinent, which existed until 1947 and included not only the Republic of India but also the present-day states of Pakistan, Bangladesh, Bhutan, and Myanmar. How the two stuffed specimens came to the Natural History Museum is largely unknown. The little information available states that the gharials entered the herpetological collection

Fig. 2. Portrait of the 5.43-metre-long male Indian gharial with the typical bulge on the tip of the snout. Next to these crocodiles, the Komodo dragon (*Varanus komodoensis*) in the background looks less impressive. Photo: André Koch.

in 1902 as a gift from Franz Steindachner (Grillitsch et al. 1996, Riedl-Dorn 1998). This information is also written in golden letters on the large display case. Steindachner (1903) himself mentions the two crocodiles briefly in his annual report for the year 1902, but without giving further details about their origin. In 1904 they were placed in the exhibition collection for the first time and initially found their place in the upper dome hall (Steindachner 1905), where they were viewed by the Emperor and his entourage the following year. Only later was the gharial group transferred to Hall 28 (Fig. 3), where amphibians and reptiles of the world are still on display today. The collector of the crocodiles is unknown, Steindachner himself did not travel to South Asia. Through numerous purchases, however, he was decisively responsible for the expansion of the collections. Unfortunately, important information on the provenance of the acquired specimens was often lost in this process (Kähsbauer 1959). And so, even in a historical guide book to the display collections of the Natural History Museum, no information is given on their origin (Kummerlöwe 1942).

About Captain Jürgen Johannsen and the Origin of the Vienna Gharials

But where do the new findings about the origin of the two Viennese gharials come from? During research for another publication (Koch 2021) on zoological relics of the controversial historical "Völkerschauen" (ethnological expositions), one of us (AK) came across the biography of Carl Hagenbeck (1844–1913, Fig. 4), the famous Hamburg animal trader, "Völkerschauen" organizer, and zoo director. In the chapter on "Small Adventures" we stumbled across the following passage (Hagenbeck 1909: 303): "Two hides of such animals [meaning the Indian Gharials] came into my possession fifteen years ago [see below], one was fourteen, the other sixteen feet long [i.e., about 425 cm and about 490 cm, if the English foot measurement of 30.48 cm is used as a basis for calculation, although the Hamburg foot measured only 28.6 cm [Mozhnik 1848], which would result in lengths of only 400 cm and 457 cm]. My traveler Johannsen, then first officer of a steamer, brought the hides to Hamburg and gave

Fig. 3. The historical postcard photo shows room 28 of the Natural History Museum before the installation of the two large Indian gharials, which took place sometime after 1904. For the display of the two extraordinary crocodiles, the middle display case, which already contained an older gharial hide hidden in the upper section, was replaced by a larger one. Photo: Archive for the History of Science of the NHMW.

them to the Umlauff company, from which I acquired them. In Vienna I later brought the two gharials to exhibition [see below about the exhibition at the Vivarium]; they are still in the Imperial Museum in Vienna."

It is thus clear from these lines that the two specimens first arrived in Hamburg from South Asia, where they were acquired by Carl Hagenbeck around 1893 (see comments below about the purchase), because the first edition of Hagenbeck's memoirs "Von Tieren und Menschen" (Of Animals and Men) was published as early as 1908. The person named "Johansen", described as a "traveler", is Captain Jürgen Johannsen (1859–1940, Fig. 5), a native of North Schleswig, for whose name alternative spellings such as Jörgen Johansen exist. Zukowsky (1929, 1954) reports that Johannsen was called "Uncle Sahib" within the company; the Indians called him "Hannsen-Sahib" (G. K. L. 1940) — with Sahib being a respectful form of address. According to Hagenbeck (1909), Johannsen went to sea from the age of fourteen and travelled all the world's oceans during his long life. Since about 1890 he is said to have worked as a travelling animal catcher and buyer for Hagenbeck with a focus on India and Indonesia (Thode-Arora 1989). According to Dittrich & Rieke-Müller (1998), Carl Hagenbeck used the services of the "former ship's officer Jürgen Johannsen from 1901 onwards" in order to become more independent from his two half-brothers Gustav (1869–1947) and John Hagenbeck (1866–1940), who had already founded their own animal trading company in Colombo in 1894, in the procurement of wild animals from India and Ceylon (Sri Lanka). For example, Johannsen brought large shipments of Indian blackbucks (*Antilope cervicapra*) to Hamburg from 1901 onwards (Dittrich & Rieke-Müller 1998). Sokolowsky (1928) further mentions that "Captain Johannsen (...) carried out extensive transports of natives for display in Europe" and was "equally at home in India, in the Indian island world [i.e., present-day Indonesia], as in Africa".

In addition, Johannsen himself was apparently involved in the organization of at least two "Völkerschauen": in 1908 he prepared the "Ceylon Village" together with John Hagenbeck and in 1913 the "Burmese Show" (Thode-Arora 1989). Information on Johannsen is otherwise very sparse (K. Gille, pers. comm.). Further details about his life and work are only known from isolated reports. For example, a newspaper article from 1930 mentions that Captain Jürgen Johannsen, "Hagenbeck's oldest animal catcher", bought an adolescent Indian rhinoceros (*Rhinoceros unicornis*) from Nepal for the top price of about 60,000 Marks for the zoo in Stellingen (Anonymous 1930, see also Anonymous 1931). Besides a short description of the rare animal — the only one of its

Fig. 4. Carl Hagenbeck (1844–1913), the famous Hamburg animal trader, ethnological show organizer and zoo director, first exhibited the hides of the two large gharials in Vienna (among other places) before selling them to Franz Steindachner of the Natural History Museum Vienna in 1902.

Fig. 5. Jürgen Johannsen (1859–1940) worked as an animal trapper and buyer for the Hamburg-based companies Umlauff and Hagenbeck for decades from around 1890. It was through him that the two gharials arrived in Europe from the colony "British India" around 1893, before Franz Steindachner acquired them from Carl Hagenbeck. Photo: from Hagenbeck (1909).

kind in the whole of Europe at that time — it is also mentioned that Johannsen apparently took care of the rhinoceros "Nepali", which had become accustomed to him, even after his return to Hamburg. On an aside, "Nepali" achieved a certain fame in the Hanseatic city and beyond, because after the Second World War when it was to be shipped to London by the British, it vehemently refused to enter the transport box. As it later turned out, Jan Schild, the keeper at the time, had secretly smeared the box with tiger excrement. In later reports about the rhinoceros Johannsen's merit is no longer mentioned (Voß 1952, Niemeyer 1972). Instead, we learn from these sources that Lorenz Hagenbeck's (1882–1956) son Carl-Lorenz alias "Carlo" (1908–1948) acquired Nepali from the Maharajah of Nepal. Thus, Carl Hagenbeck's grandson, like his son Lorenz, also went on voyages with Captain Johannsen to acquire wild animals in Asia (see below). Incidentally, Nepali was taxidermied for the Zoological Museum of the University in Hamburg after her death in 1955 and is still exhibited there today (Glaubrecht 2018).

Hagenbeck's (1909) memoirs do not tell us anything concrete about the catcher of the gharials and their exact origin, but he writes that the aforementioned Johannsen told him the following: "Three years ago [i.e., probably in 1905], when he was travelling down the Brahmaputra on a large barge with a transport of elephants from Assam [in north-eastern India], he observed two gharials whose length he estimated to be at least twenty-five feet [which would correspond to 717.50 cm to 800 cm (!), depending on the length of the unit of measurement feet used (see above)]. He also shot at the animals without getting hold of them. Since the crocodiles had been hit, Johannsen offered the captain of the boat 300 rupees if he would stop so that the prey could be taken on board. But it was in vain, because of the strong current it was not possible to stop the vessel." So, although it remains speculative, Johannsen could also have killed the two Vienna gharials on a voyage on the Brahmaputra from north-eastern India through what is now Bangladesh to its mouth in the Bay of Bengal.

That Johannsen probably travelled this route regularly is evident from another source. Ludwig Zukowsky (1888–1965), who was employed for many years as scientific director in Hagenbeck's zoo, writes in his book about "Carl Hagenbeck's empire" (Zukowsky 1929), that Johannsen is said to have brought almost 800 elephants to Hamburg-Stellingen during his (circa 40 years) work for the Hagenbeck family (in this respect Leutemann [1887] remarks that until this year already about 300 elephants, mainly Asian, had passed through Hagenbeck's hands). Umlauff (undated) writes on this: Johannsen was "one of the best people for Hagenbeck, who brought large animal transports from all regions. Most of all he brought elephants. Never before has anyone imported so many elephants and also caught them himself as Captain Johannsen, in this he really beat the record." In this context, Brandes (1911) provides a detailed account of

Fig. 6. Johannes Umlauff (1874–1951) continued his father's trade in naturalia from 1912 and originally introduced Carl Hagenbeck to Captain Johannsen. The Umlauff company sold several gharial hides (among others) to the natural history museums in Vienna (see Figs. 1 and 2), Frankfurt (see Fig. 12) and Bucharest (see Fig. 13). Photo from Anonymous (1951).

Johansen's capture and taming of elephants, supplemented by photographs of the lengthy procedure. Niemeyer (1972) reports that "Hagenbeck's traveler Johannsen, who had become a Dane due to the new border demarcation [as a result of the First World War], [in 1922] brought 13 elephants, 300 monkeys and several carnivores from India. 22,000 citizens of Hamburg inspected the animals destined for America." It was the first large animal transport to return to Hamburg after the war. Among them were (live?) crocodiles (Hagenbeck 1955). Johannsen and other "travelers" also arranged extensive animal transports for the reopening of the Stellingen Zoo, (which had been closed since 1920), on 24 May 1924 (Niemeyer 1972: 256). In contrast to many other animal trappers such as Lorenzo Cas(s)anova, who was sent into the wide world on behalf of the Hagenbeck company from 1865 onwards and succumbed to a tropical disease (Hagenbeck 1909), Jürgen Johannsen seems to have survived these hardships relatively unscathed into old age. Carl Hagenbeck's younger brother Diedrich (1852–1873) also died prematurely of "black water fever" while hunting hippopotami in Zanzibar (Niemeyer 1972).

Johannsen's Work for the Hamburg Family Businesses of Hagenbeck and Umlauff

As Hagenbeck's (1909) own descriptions show, Johannsen also worked for the Hamburg-based company "J.F.G. Umlauff ", which traded internationally in naturalia and ethnographica (see also Thode-Arora 1992). The Umlauff family business in natural products goes back to the company founder Johann Friedrich Gustav Umlauff (1833–1889), who acquired a bathing establishment in Hamburg St. Pauli in 1859 and began selling curiosities from overseas (Thode-Arora 1992, Lange 2006). As the largest German overseas port, Hamburg offered the best conditions for this, which was further promoted by the emerging colonial policy from the 1880s onwards. As early as 1863, Johann Umlauff married Caroline Hagenbeck (1839–1918), a sister of Carl Hagenbeck, in his second marriage, which explains the close business relations of both Hanseatic family enterprises. Live animals imported by Hagenbeck that died prematurely were passed on to Umlauff, who in turn "stuffed" them and resold them to natural history museums or other interested parties (Leutemann 1887) — sometimes even as far as Mongolia (Hanelt et al. 2020). However, Umlauff also engaged its own animal trappers such as Johannsen, who were taught preservation and taxidermy skills in order to be able to transport hunted specimens safely to Europe, where they were further processed (Lange 2006). After moving into new exhibition rooms in Hamburg, the expanding company was given the name "J.F.G. Umlauff Naturalienhandlung und Museum" or "Museum Umlauff" or "Umlauffs Weltmuseum" [Umlauff's world museum] for short. In 1912, the various business areas of the Umlauff family, which included the sale of naturalia as well as the trade in ethnographica and shell products, were divided among Johann F. G. Umlauff's children. However, all three companies initially retained the name "J.F.G. Umlauff Naturalienhandlung und Museum". Johannes Umlauff (1874–1951, Fig. 6), a son of the company's founder, thus became the owner of the zoological branch of the business, which later traded under the name "Johannes Umlauff — Lehrmittel- und Naturalienhandlung" (G. V. B. 1944), until the business was destroyed during the Second World War (Thode-Arora 1992). However, individual specimens were still sold to natural history museums until at least 1950, as Niethammer (1954) mentions for the Museum Koenig in Bonn.

In his unpublished memoirs, a copy of which is in the Hagenbeck archives in Hamburg, Johannes Umlauff (undated: 30) describes how he once met the "1st officer Johannsen" on board the Bremen steamer "Drachenfels" and found "a loyal friend" in him. As a result, the latter initially brought fish from Bombay to Hamburg from his trips to India for Umlauff. Due to Johannsen's interest in animals, these deliveries became more and more extensive, as Umlauff continues. Apparently, the contact between Carl Hagenbeck and Johannsen came about through Johannes Umlauff himself (even if this is not mentioned in Johannsen's obituary, see e.g., G. K. L. 1940), because on the occasion of a "[...] large transport of animals, which D. "Drachenfels" had on board and had been purchased by my uncle Carl Hagenbeck, I introduced Johannsen [...] to my uncle." The steamer "Drachenfels" was in the service of the "Deutsche Dampfschifffahrts-Gesellschaft" [German Steamship Company, DDG] "Hansa" from Bremen from 1882, which "[...] established a regular liner service to Colombo (in Sri Lanka) and Calcutta at the end of 1888 with the founding of the Asiatische Linie" (Patzer 2005). According to this source, the DDG "Hansa" was the largest pure cargo shipping company in the world in 1914 with 66 steamers and one motor vessel.

The Purchase and first Display of the Indian Gharials in Vienna by Carl Hagenbeck

Another aspect mentioned by Carl Hagenbeck (1909: see above) in his memoirs is the exhibition of the two gharials before they reached the Natural History Museum Vienna. For another line of business of this famous businessman, which has hardly been illuminated so far, was the organization of reptile exhibitions, such as the one beginning on Easter Sunday, 1897 in the Vivarium in the Vienna Prater (Reiter 1999; Fig. 7). In the accompanying advertisement of 18 April 1897 in the newspaper "Wiener Caricaturen" [Viennese caricatures] about the "largest reptile exhibition in the world", "Risenkrokodile" [giant crocodiles] were announced among other things as a special attraction (Fig. 7). Since the name of the gharial was probably unknown to most people at that time, as it is today, it can be assumed that the two large gharials were hidden behind the attention-grabbing name "giant crocodiles", even though there are no more precise references to this. An eyewitness account, which probably refers to the gharial group, comes from Eduard Paul Tratz (1889–1976), the later founder and for many years controversial director of the Haus der Natur in Salzburg (Hoffmann & Lindner 2021). In his "Erinnerungen an die Kinder- und Jugendzeit" (Memories of Childhood and Youth), he describes the time he spent in Vienna from 1894 to 1898 and how, at a young age, he was captivated by the "Hagenbeck'schen Menagerie (...) and the specimen of a giant crocodile placed in the middle of the hall [of the Vivarium]. Around it were numerous small basins and containers filled with all kinds of reptiles, amphibians and fish" (Hoffmann & Lindner 2021: 799). Although Tratz only mentions one prepared giant crocodile in his personal memoirs, this inaccuracy could be due to the long time span of about 50 years between the experience and its recording in writing.

Regarding the original purchase of the two stuffed gharials by Carl Hagenbeck, some information was found in the company's historical account books, which survived World War II. Thus, in the volume for the years 1896 and 1897, on pages 464–465, there is a series of entries for the Vivarium in Vienna from 3 March to 17 September 1897 (Fig. 8). The first entry on page 464 lists, under running number 120, "2 ausgest[opfte]. Krokodile" [two stuffed crocodiles]. The prices are given as 300 and 700 Marks, respectively, accounting to a total of 1000 Marks (which today would correspond to just under 8,000 Euros). This high price already denotes that these crocodiles must have been something special. Although, unlike other entries, no scientific or common species name is mentioned, it is quite likely that the two large gharials are meant, as the date of purchase is only a few weeks before the opening of Hagenbeck's reptile exhibition at the Vivarium (see above). On the same page, for instance, there is an entry in the penultimate line about "2 ind[ische]. Krokodile" [2 Indian crocodiles], probably *Crocodylus palustris*, for 250 Marks in total, and on page 465 three entries about

Eröffnungs-Anzeige.

VIVARIUM

II. k. k. Prater, Hauptallee 1.

Direction: Karl Hagenbeck.

Eröffnung: Ostersonntag, 18. April 1897.

Grösste Reptilienausstellung der Welt

in künstlerisch ausgestatteten Käfigen.

60 Riesenschlangen von 6—28 Fuss Länge. Riesenschlangen mit Jungen, Riesenkrokodile und Alligatoren mit Jungen. Hunderte von Schlangen, Echsen, Schildkröten, Frö-chen, Molchen etc. in den verschiedensten europäischen und überseeischen Arten.

Geöffnet täglich von 9 Uhr Früh bis Abends.

Entree 30 kr., Kinder 15 kr. 325

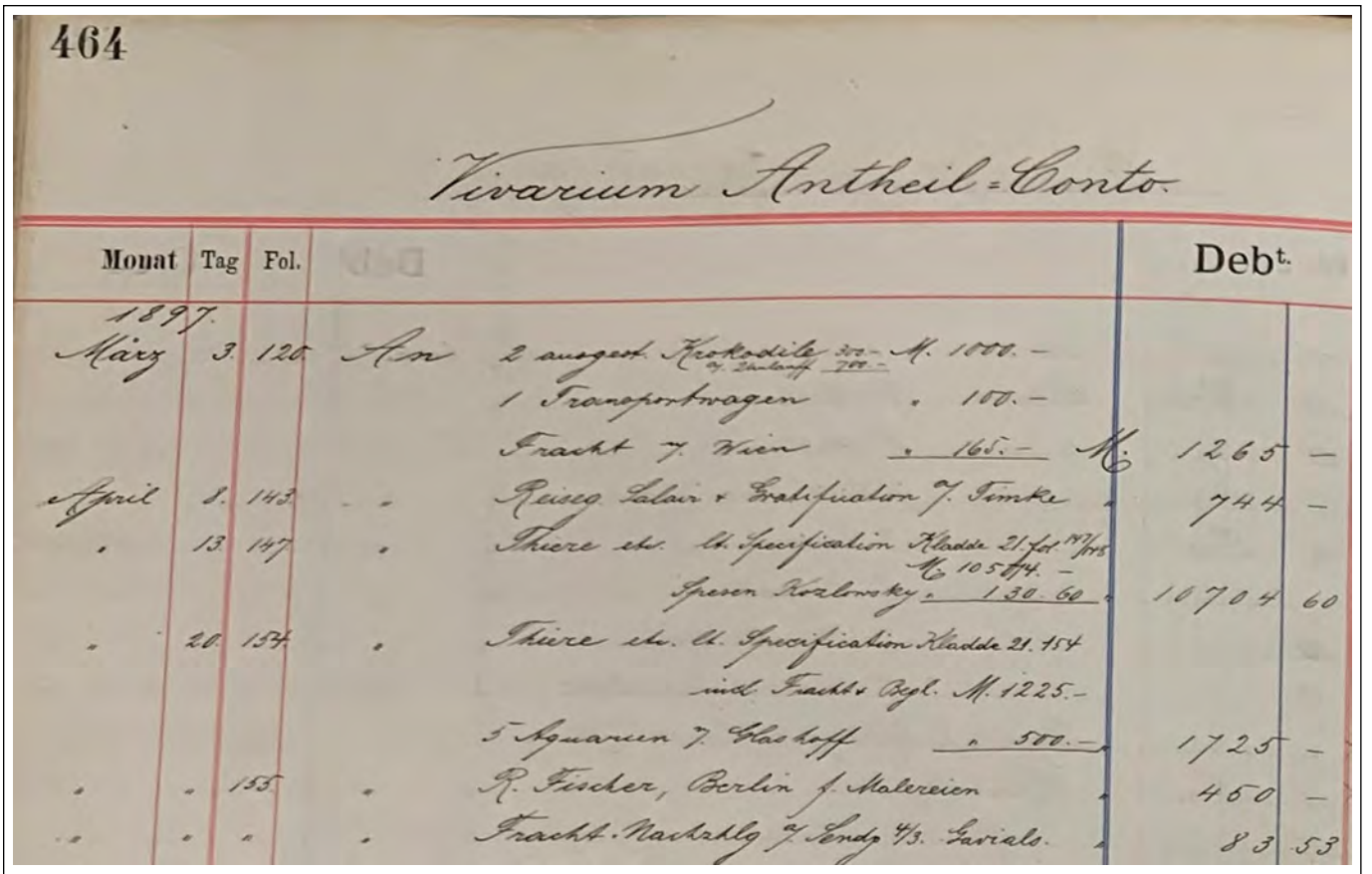
Fig. 7. The opening advertisement about Karl Hagenbeck's allegedly "largest reptile exhibition in the world" in the former so-called Vivarium in the Vienna Prater in the "Wiener Caricaturen" newspaper of 18 April 1897. Giant crocodiles ("Riesenkrokodile") were announced as a special attraction and probably referred to the two large gharials.

"westafrik[anische]. Krokodile" [West African Crocodiles], probably *Crocodylus suchus* or *Mecistops cataphractus*) ranging from merely 10 to 25 Marks per specimen. In comparison, four seals and a walrus, among others, purchased later that year to populate an artificial polar landscape in the Vivarium's courtyard (Reiter 1999), cost Hagenbeck 180 Marks and 3,000 Marks, respectively.

Regarding the presumed gharials, it is somewhat striking that that total sum was split into two amounts of money, which are written below each other, 300 above and 700 below. To the left of the 700 is noted "a/[n] Umlauff" [to Umlauff], which means that (at least) 700 Marks were paid to the company of J.F.G. Umlauff for the crocodiles. One possibility could be that the different prices stand for the female (300 Marks) and male specimen (700 Marks), respectively. On the other hand, the 300 Marks could represent Captain Johansen's share, even if this is not explicitly mentioned.

In addition, the next two lines of the account book show the costs for freight and the transport wagon for the presumed giant crocodiles, 100 and 165 Marks respectively, so that the total sum for these two specimens alone is 1,265 Marks. Remarkably, a few lines later, there is another entry, which clearly shows that the stuffed crocodiles were indeed gharials. Thus, for 20 April — only two days after the opening of the reptile exhibition — there is the entry: "Fracht-Nachzhlg a/ Sendg 4/3 Gavials" [additional freight payment to consignment of the gharials of 4 March] for 83.53 Marks. Although there is no entry for 4 March, it can be assumed that this line refers to the purchase of the stuffed crocodiles from the previous day. Perhaps they were sent from Hamburg to Vienna on 4 March or it is merely a minor inaccuracy.

Nevertheless, despite his well-known name and the various animal attractions such as the "giant crocodiles", Carl Hagenbeck was unable to prevent the bankruptcy of the Vi-


464

Vivarium Antheil-Conto.

Monat	Tag	Fol.			Debt.	
1897.						
März	3.	120	An	2 ausgest. Krokodile [illegible] M. 1000.–		
				1 Transportwagen „ 100.–		
				Fracht f. Wien „ 165.–	M.	1265 –
April	8.	143	„	Reiseg. Salair + Gratification f. Timke	„	744 –
„	13	147	„	Thiere etc. lt. Specification Kladde 21 fol 147/148 M. 10574.–		
				Spesen Kozlowsky „ 130.60	„	10704 60
„	20	154	„	Thiere etc. lt. Specification Kladde 21. 154 incl. Fracht + Zoll. M. 1225.–		
				5 Aquarien f. Glashoff „ 500.–	„	1725 –
„	„	155	„	R. Fischer, Berlin f. Malereien	„	460 –
„	„	„	„	Fracht-Nachzllg f. Sendg 4/3. Lariats	„	83 53

Fig. 8. Hagenbeck's historical account book for the years 1896 and 1897. On page 464, the first entry lists "2 ausgest[opfte]. Krokodile" (i.e., two stuffed crocodiles) for a total of 1000 Marks, which were transported to Vienna. Very likely these are the two large gharials. For further details see the text. Photo: Nigel Rothfels by courtesy Tierpark Hagenbeck Archive, Hamburg.

enna Vivarium in the Prater, which was built in 1873 on the occasion of the Vienna World's Fair (Werner 1901, Reiter 1999). In any case, it is quite conceivable that Franz Steindachner discovered the two "giant crocodiles" or gharials during their display in the Vivarium and subsequently acquired them from Carl Hagenbeck for the Natural History Museum Vienna because of their high show value.

Further unpublished Archive Material on the Viennese Indian Gharials

The undated typewritten manuscript by Johannes Umlauff is accompanied by a black and white copy of a photograph of two gharial hides (Fig. 9). As can be seen from the posture and external appearance, the group of gharials is without doubt the two Viennese crocodiles. The photograph must therefore have been taken before 1902, when the two specimens arrived at the Natural History Museum Vienna. Carl Hagenbeck's zoo grounds in Hamburg-Stellingen are rather out of the question as the place where the prepared crocodiles were photographed, because the "first zoo in the world without bars", whose patent he had applied for in 1896, was not opened to the public until 1907, even though extensive work had already begun on the grounds in 1902 (Hagenbeck 1909). Alternatively, it could be the Hagenbeck premises at Neuer Pferdemarkt in Hamburg city center, from where the animal trade was operated (K. Gille, pers. comm.), or an area of the Umlauff company, which carried out the taxidermy. Another possibility would be the Vienna Prater (see above). In any case, it is unlikely that the two precious specimens were kept outdoors for a long time. Presumably it was merely a provisional staging for which the two impressive gharials were positioned on straw or sod in order to photograph them as lifelike and attractive as possible for potential buyers.

Previously unknown Drawings of a record-breaking Gharial Skull

In addition to this remarkable historical photograph of the Viennese Indian gharial, Umlauff's manuscript also includes a sheet with two drawings of the head of a male specimen: a lateral portrait and a dorsal view (Fig. 10). In addition to the note that "the occiput of the skull is defective", the undated drawings also contain three length measurements. Thus, for the distance from the eyes to the tip of the snout 57 cm are given, for the "length of the oral fissure 71 cm" and for the "total length of the lower jaw [even] 85 cm". However, the total length of crocodile skulls is measured by default from

the tip of the snout to the posterior end of the cranial skull plate (Webb & Messel 1978). In the drawing of the male gharial, this point lies quite exactly between the angle of the oral fissure and the terminal point of the mandible (Fig. 10). The length of the skull is therefore about 78 cm. Thus, if the measurements given were correct, this specimen had the longest known skull of an Indian gharial! The previous record holder is in the Zoological State Collection in Munich and is given by Whitaker & Whitaker (2008) with a total length of 77.3 cm. Only two centimeters shorter than this specimen — namely 75.3 cm — is a gharial skull from the Muséum National d'Histoire Naturelle in Paris (MNHN). We do not have the skull measurements of the male specimen mentioned below, which is exhibited in the French capital and originally measured 5.40 meters in length (Fig. 11). The Museum Koenig in Bonn also has two extremely large gharial skulls, measuring 75 cm and 72.7 cm, respectively (Böhme 2021). The Munich specimen with the indication of origin "India" is listed by Whitaker & Whitaker (2008) as the third longest crocodile skull ever (the world's longest skull of this archaic reptile group with a total length of 84 cm is in the Natural History Museum in London and belongs to a *T. schlegelii*), although the extreme skull length of gharials due to their narrow, elongated snout does not suggest record values for the total body length of the respective individual. According to the body proportions of 1:5 to 1:6.5 calculated by Whitaker & Whitaker (2008) for the genus *Gavialis*, this would indicate a total length of the depicted animal of "only" 390 cm to 507 cm.

Fig. 9. Copy of a photograph of the two (freshly set up?) gharials enclosed with the memoirs of Johannes Umlauff in the Hagenbeck archive in Hamburg. The photo was probably taken between about 1893 and 1902, most likely in Hamburg or Vienna, before the extraordinary specimens were sold by Carl Hagenbeck to the Natural History Museum in Vienna. Photo: Tierpark Hagenbeck Archive, Hamburg.

A certain "Dr. R. Ewald" is given as the author of the remarkable drawings, but at first, we were unable to find information about a person with this name. Only when insights into the extensive correspondence file of the Umlauff company from the Museum für Naturkunde in Berlin were made possible a few months later, we found a mention of the "Scientific Assistant Dr. R. Ewald", who was responsible for the processing of preserved bird heads, in a typewritten letter from Johannes Umlauff (1922), dated 1 February 1922. A follow-up letter dated 3 February 1922, dealing among other things with the identification of reptiles, amphibians, and fish for the preparation of sales lists, is signed with "für Johannes Umlauff i[n]. V[ertretung = on behalf of]. Dr. R. Ewald" (Ewald 1922). The determination of the material was again the responsibility of the scientific assistant. It has not yet been possible to clarify when Mr. Ewald started working for Johannes Umlauff's company. However, it seems unlikely that he was already working for the Hamburg company at the end of the last century, when the two large gharials were prepared there before they reached Austria. On a side note, Friedrich Siebenrock (1853–1925) helped the Umlauff company with the identification of turtles and crocodiles during his work as curator of the NHMW (Steindachner 1907).

The discrepant dimensions of the male gharial in the Natural History Museum Vienna also speak against the specimen drawn by Ewald being the Viennese crocodile. Its head measures 63 cm from the eye to the tip of the snout on the left and 62.5 cm on the right, the oral fissure 79 cm, and the lower jaw even 86 cm. With an average value of 82.5 cm, as described above, it thus has a slightly longer skull than the specimen shown (Fig. 10), which correlates with its total length of 543 cm and corresponds to a ratio of 1:6.58. This size ratio is slightly above the values of 1:5 to 1:6.5 determined by Whitaker & Whitaker (2008) for gharial. It thus remains unclear to which specimen Ewald's drawing is referring and to which museum it was finally sold.

In addition, a discovery in the Archive for the History of Science of the NHMW is worth mentioning. In the minutes of the director's records for the year 1895, the following is noted under the item "Subject" in business number 385 of 14 June: "J.F.G UMLAUFT [sic] in Hamburg offers a gharial hide for sale. Under the item "Erledigung" it simply says: "Hofrath Steindachner notified." Steindachner's decision in this matter, however, is not documented in the minute book, and Umlauff's letter can no longer be found in the archives. Consequently, it is unclear whether there is merely a mistaken reference to only one hide (just as the company name was

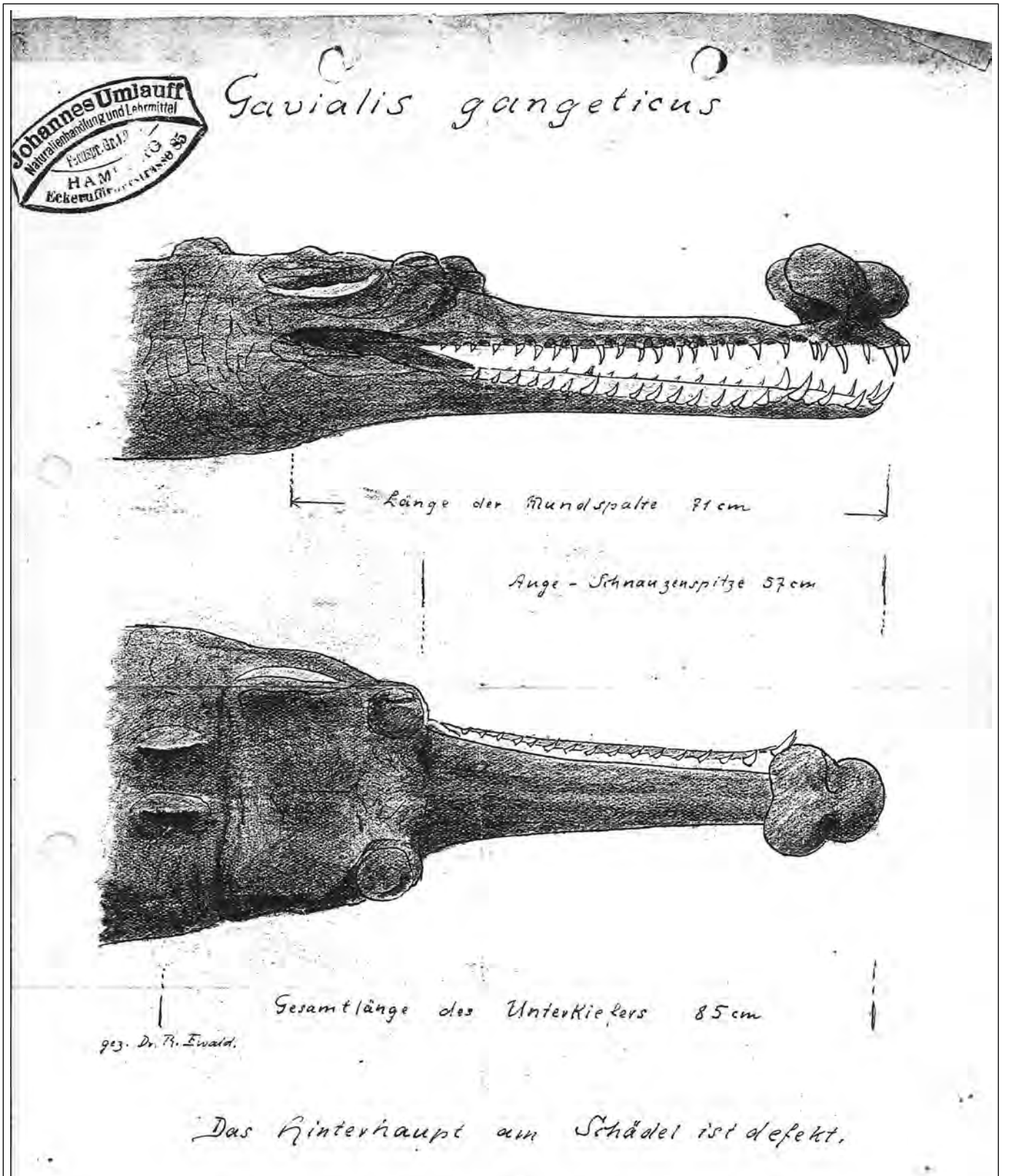

Gavialis gangeticus
Johannes Umlauff
Naturalienhandlung und Lehrmittel
Länge der Mundspalte 71 cm
Auge - Schnauzenspitze 57 cm
Gesamtlänge des Unterkiefers 85 cm
gez. Dr. R. Ewald.
Das Hinterhaupt am Schädel ist defekt.

Fig. 10. A copy of two undated drawings of the head of a male gharial, also enclosed with the manuscript by Johannes Umlauff. The author "Dr. R. Ewald" worked as a scientific assistant for Umlauff. Due to deviating length measurements (see text), this is not the male gharial in Vienna. The drawn specimen, whose whereabouts are unknown, had an estimated total length of 390 cm to 507 cm. Photo: Tierpark Hagenbeck Archive, Hamburg.

Fig. 11. The largest Indian gharial (MNHN-RA-0.7581) in the Muséum National d'Histoire Naturelle in Paris dates from the first half of the 19th century and is said to have originally been 5.40 meters long. Since the tip of the tail is now missing, the specimen only measures 5.15 meters today. Photo: Annemarie Ohler.

misspelled) or whether it is actually the large gharial group that Steindachner acquired from Carl Hagenbeck in 1902 at his own expense. However, it is more likely that it could be another gharial specimen that was already purchased by Steindachner before the large group. For in the database of the herpetological collection two other adult Indian gharials are listed (NHMW 562 and NHMW 1978), which are noted as donations of the then intendant Steindachner; the length of the second specimen is given as 353 cm.

In a historical photograph of Hall 28 from 1890 in Krenn et al. (2021), the elongated snout of an Indian gharial is clearly visible. A comparison with the postcard shown in Fig. 3 shows that this specimen can also be seen there in the middle display case. Whether, and if so, which of the two crocodiles mentioned above it is, is unclear, but in any case, it does not come into consideration for the offer from the year 1895. However, this at least proves that the Indian gharial was already displayed in the Natural History Museum before the large group was set up, which is not surprising in view of its morphological uniqueness. In addition, the note in the file documents that the Umlauff company offered (at least) one prepared gharial for sale to the NHMW as early as 1895. Further letters in the historical archives of the NHMW attest to the decades-long business relationship between the Hamburg trading company and the Viennese museum (for further details see below).

More Indian Gharials in (non-)European Natural History Museums

When researching the two Hanseatic trading companies Hagenbeck and Umlauff, it became clear to us that the two Viennese gharials were not the only specimens of this extraordinary crocodile species sold by the Umlauff company to European natural history museums. Carl Hagenbeck (1909), who is known to have already done at least one lucrative business with these crocodiles, writes: "The traveler [i.e., Jürgen Johannsen] took with him on a new journey to India the order to keep a lookout for large gharials and to bring back at least the hides." Elsewhere, the Hanseatic animal trader boasts that in the course of his life "more than 2000 crocodiles have passed through [his] hands". However, this phrase probably does not refer to Indian gharials, because Hagenbeck (1909) also admits: "I have tried to import young specimens [of the Indian gharial] on various occasions, but they have all perished on the journey". He considered it hardly feasible to catch and transport adult specimens. Accordingly, there are, for example, no gharials on a price list from 1883 printed in Leutemann (1887: 39ff), although several Indian elephants and numerous alligators, probably *Alligator mississippiensis* from North America, are offered therein.

In this context, it is interesting to note what Johannes Umlauff (undated: 31) states: "Capt. Johannsen had the good fortune to trade two huge gharials [handwritten addition of the word "skins"] (the sacred Ganges crocodile) from an old Radja in Bombay, when he went up the Ganges to catch animals. There were two huge skins, one specimen was 8m from head to tail, and the other 7.50m. We had never seen such large specimens [see the note at the end of the article]. As they were little tanned and very difficult to work with, I had them prepared in our workshop. After completion, I immediately sold them ~~an das Senkenbergesche~~ [sic] ~~Institut, Frankfurt a.M., Geheimrat Prof. zur Strassen.~~ [= to the Senckenberg Institute (Museum), privy councilor Prof. zur Strassen; handwritten deletion in the manuscript with the following substitution:] Pracht Exemplare an Prof D: Antipa Bukarest

— 19 —

schrank fallen zwei besonders starke Krokodile auf: das im ganzen tropischen Afrika und auf Madagaskar häufige Nilkrokodil (Crocodylus vulgaris Cuvier; Abb. 16) und der indische Gavial (Gavialis gangeticus Gmelin; Abb. 17). Durch die stark verlängerte, schmale Schnauze mit dem knolligen Aufsatz ist der Gavial unter den etwa 20 gegenwärtig lebenden Krokodilarten entschieden die sonderbarste.

Abb. 16.

Abb. 17.

Zum Schluß müssen wir noch auf ein Reptil in dem gleichen Schrank hinweisen: auf die berühmte Brückenechse (Sphenodon punctatus Gray; Abb. 18), die einzige noch lebende Art der

Fig. 12. Drawing of a male Indian gharial (SMF 8082) over four meters long from Umlauff, which was exhibited in the Senckenberg Museum in Frankfurt until the Second World War and became a victim of the bombings. Photo: from Mertens (1925).

Museum, Frankfurt a.M., Senkenbergisches Institut." Thus, it is evident from these corrected memoirs that at least two other large gharial specimens were delivered by the Umlauff company to the natural history museums in Bucharest and Frankfurt.

The former Indian Gharial of the Senckenberg Museum in Frankfurt

Our enquiry with colleagues at the Senckenberg Museum in Frankfurt (SMF) revealed that a large specimen did indeed exist there, formerly acquired by "J[ohannes]. Umlauff" (Mertens 1943). In the annual report of the Senckenbergische Naturforschende Gesellschaft [SNG, Senckenberg Natural History Research Society] for 1914, the said gharial is mentioned as a "gift from Dr. Oscar Löw-Beer" (1878–1938), a benefactor and member of the SNG's directorate (Kramer 1967), with a length of over four meters and the announcement that it "will later form one of the ornaments of our [display] collection" (Anonymous 1916). Löw-Beer, who had made his fortune in the chemical industry, had himself undertaken a business trip to India and Sri Lanka in 1912 and collected naturalia there (Anonymous 1920), but had obviously not brought a gharial with him. Mertens (1943) also lists three gharial skulls in the Frankfurt collection (SMF 28132, 28133, and 40144), which were acquired by Johannes Umlauff in 1939 and 1940.

Otto zur Strassen (1869–1961), whose name was crossed out in Umlauff's manuscript (see the quotation above), had been museum director in Frankfurt since 1909 and was very probably Umlauff's negotiating partner for the purchase of the gavial. This business relationship is clearly documented at the latest in connection with another spectacular specimen. It is a large Anaconda skin from Brazil, which Umlauff sold to Senckenberg in 1925 for 100 Marks and which was probably set up in an extraordinary manner by taxidermist Christian Kopp (1893–1952) on site (Becker 2020). The South American giant snake is depicted in the critical phase of devouring with a Capybara in its maw (Becker & Lotzkat 2019).

The gharial specimen acquired for the Senckenberg Museum in 1914 was given the inventory number SMF 8082 and, according to the corresponding index card, was exhibited in the "Schaus[ammlung = display collection]." Mertens (1925), who reports on "the reptiles [...] in the Senckenberg Museum's display collection", only depicts the drawing of a male adult gharial (Fig. 12); not, however, the recently acquired anaconda. It thus remains open whether the gharial from the exhibition is depicted, as most of the other reptiles on display are shown in photographs. The same drawing is also found in the museum guide from 1935 (Anonymous 1935).

Neither in Mertens (1943) nor on the corresponding index card of the specimen in the herpetological collection is the alleged origin of the crocodile from Umlauff's memories, i.e., the river Ganges, noted. Instead, the word "destroyed!" is subsequently added to the index card in biros, since the Senckenberg specimen was apparently destroyed in 1944 during the partial destruction of the museum during the bombing of Frankfurt (Schäfer 1967). Mertens (1967) only mentions in general terms that the war losses affected "mainly some beautiful showpieces", while the herpetological research collection was largely spared due to removal from storage.

The Gharials of the National Museum of Natural History "Grigore Antipa" in Bucharest

The following could be found out about the other gharials, which according to Umlauff (undated) were sold to the Natural History Museum in Bucharest. According to the Romanian colleagues, there are three old specimens in the collection — a juvenile, a subadult, and an adult female specimen (Fig. 13) — as well as three invoices from the Umlauff company from the years 1907, 1908, and 1911 in the archive, which list two gharials as well as a skull; the latter, however, at a price of 140 Marks, is crossed out in pencil and annotated with "Nu", Romanian for no. The gharial skull is accordingly not in the Bucharest collection. On the homepage of the Muzeul Național de Istorie Naturală "Grigore Antipa" (MGAB), the only information about the scientific collections is that the then director "Grigore Antipa [1867–1944] led an intense activity to bring to the museum valuable collections — exotic, rich, and diverse material. For this purpose, he contacted specialized companies from abroad (Austria, Germany) with a

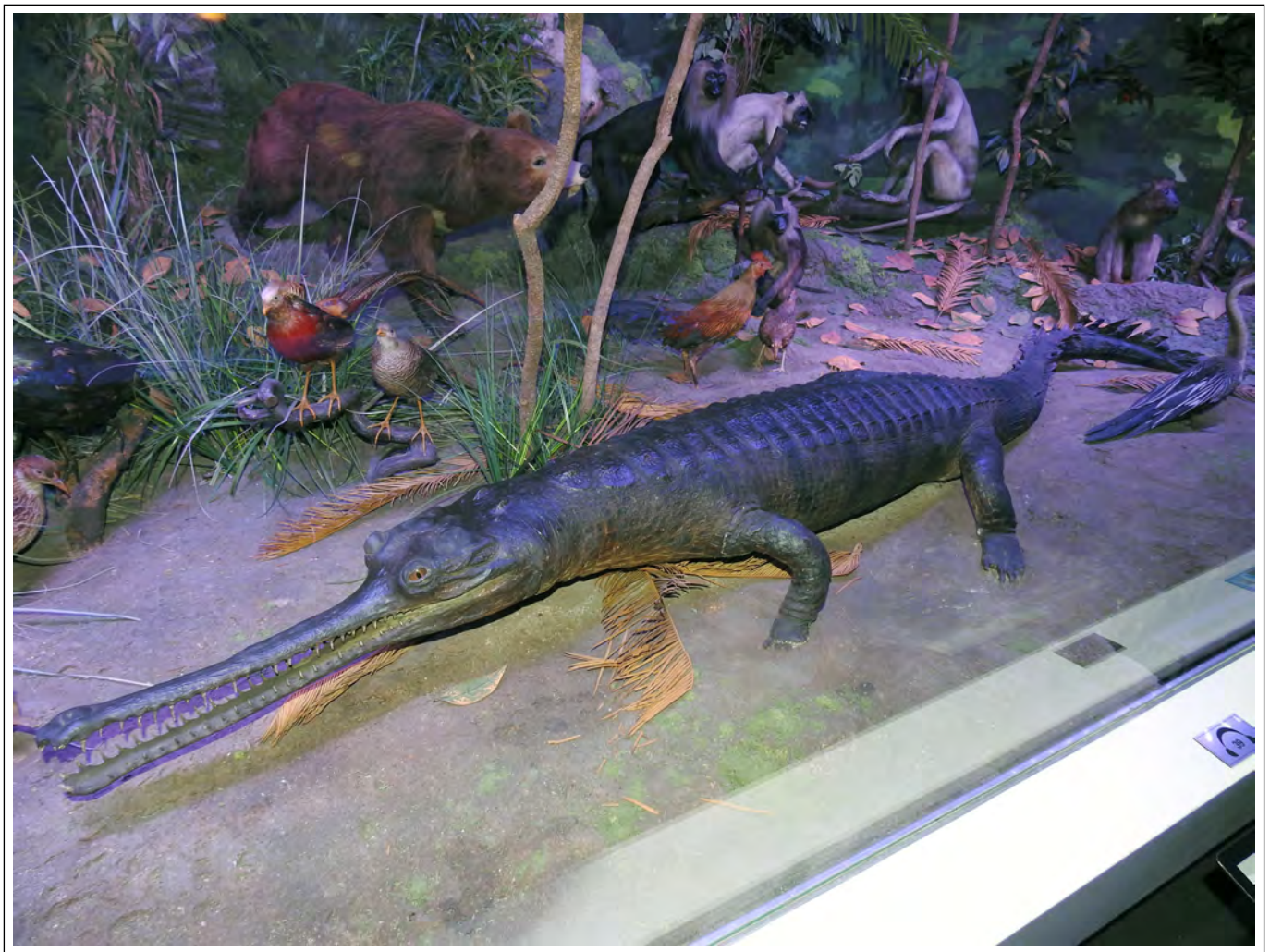


Fig. 13. The largest of three gharials (MGAB HER 7123) in the Muzeul National de Istorie Naturală "Grigore Antipa" in Bucharest, a female. It probably also comes from the company Umlauff from Hamburg and measures 312 cm. Photo: Alexandru Iftime.

view to making acquisitions." In the course of these efforts to increase the collections, the second gavial from Umlauff's memoirs mentioned above, as well as another specimen from Hamburg, most likely arrived in the Romanian capital. On the preserved invoices from 1907 and 1908, both taxidermied specimens are listed at 400 Marks each. The largest of the three specimens, a female (MGAB HER 7123, Fig. 13) measuring 312 cm in length, is displayed together with the juvenile gharial (MGAB HER 7088) in a diorama in the museum's permanent exhibition, while the middle-sized crocodile (MGAB HER 7106) is kept in the scientific collection and is only used for temporary special exhibitions.

Were Gharial Hides also sold to North America?

The interest in the impressive crocodiles from South Asia was apparently not limited to Europe alone. Thus, we learn from the biography of Lorenz Hagenbeck (1955), Carl Hagenbeck's second son, that he was sent by his father on his first mission to India in 1903 to buy various wild animals, including gharials. Hagenbeck Junior (1955) writes: "[...] I was already looking forward to going up the Brahmaputra with a native crocodile hunter after loading our transport, because we [— presumably he and Captain Johannsen —] had, among other things, the task of shooting two of the huge Indian gharials, those enormous pointed-snouted crocodiles that reach a length of eight to ten meters, for an American museum." However, Lorenz Hagenbeck's joy over the upcoming hunting trip lasted only a short time, because, as he continues to write, soon afterwards he received a telegram from his father in Hamburg with the strict order to "immediately load the transport on the steamer 'Ehrenfels'. The rest is taken over by Walter Ebert (another of Hagenbeck's animal trappers, see e.g., Zukowsky (1929) and Marben (1939)), who arrives in Calcutta a fortnight later." Whether gharial hides were nevertheless sold to America at a later date is not mentioned in the published sources (Hagenbeck 1909, 1955). Enquiries to major US natural history museums in New Haven (Yale Peabody Museum), Chicago (Field Museum), Washington (National Museum), Pittsburgh (Carnegie Museum), San Francisco (California Academy of Sciences) and

New York (American Museum) were unsuccessful or have not yet been answered. The US database VertNet also lists no gharials by Umlauff. The American Museum in New York only has "2 Chilean frogs (*Eupsophus*) collected 1885 by Umlauff, exchanged from the Naturhistorisches Museum Vienna in 1925" (David Dickey, writ. comm. 2023).

Johannes Umlauff's record-breaking Length Data for Indian Gharials

In this regard, the length specifications of 7.5 meters and 8 meters for the two specimens in Frankfurt and Bucharest, which are reproduced from Umlauff's manuscript, should be discussed once again. Obviously, these measurements are a gross exaggeration, because in one report, the Senckenberg specimen is given as being only over four meters long (Anonymous 1916). Johannes Umlauff's tendency to inaccuracies and exaggerations has already been pointed out elsewhere (Thode-Arora 1992: 146). On the other hand, Lorenz Hagenbeck (1955), as quoted above, also wrote that gharials would reach a total length of eight to ten meters. Perhaps Umlauff and Hagenbeck were referring to Captain Johannsen's gharial sightings on the Brahmaputra (see above). To what extent these observations correspond to so-called "sailor's yarn" must be left open. In contrast to the saltwater crocodile (*Crocodylus porosus*, see Fukuda et al. 2018, Ziegler et al. 2019), no Indian gharial with a length of more than six meters has been verified to date. Whitaker & Whitaker (2008), however, assume that this Asian crocodile species can certainly reach a length of over six meters.

According to William Temple Hornaday (1854–1937), the founding director of the Bronx Zoo in New York, who vividly describes in a travelogue the hunting of gharials on the river Jumna (Yamuna), a tributary of the Ganges, in 1877 and 1878, there is supposedly a stuffed specimen of "20 feet, 7 inches" length, i.e., the equivalent of 6.27 m (Hornaday 1885: 54) in the Paris Museum of Natural History. And indeed, a large male gharial (MNHN-RA-0.7581, Fig. 11) is exhibited in the Grande Galerie de l'Evolution [= Great Gallery of Evolution] of the MNHN, but its length is currently "only" 5.15 m (https://science.mnhn.fr/institution/mnhn/collection/ra/item/0.7581); however, the tail tip is missing. Thus, the specimen is slightly longer than the largest historical specimen in the Natural History Museum in London, which has a total length of five meters (Boulenger 1889). Interestingly, Duméril & Bibron (1836: 139) give 5.40 meters for the longest male in Paris at the time (in 1987, according to internal notes, the specimen measured only 5.30 meters), which was sent to France from Bengal, i.e., northern India, by Alfred Duvaucel (1793–1824), a stepson of George Cuvier (1769–1832); a female in the Paris collection is only slightly shorter, write Duméril & Bibron (1836), but no such specimen is listed in the MNHN's online database.

The Legacy of the Umlauff and Hagenbeck Companies at the NHMW

Even if not all questions about the Viennese Indian gharials could be answered beyond doubt, their provenance is now somewhat better documented. For example, there is still the question of what happened to the crocodiles in the almost 10 years between about 1893 and 1902 after they arrived in Hamburg from South Asia? Were they immediately prepared and exhibited in Umlauff's own trade museum? Or did Carl Hagenbeck acquire them shortly after they were prepared and exhibit them himself in the premises of his animal trade business and/or during the reptile shows that had been held at different locations since 1878? Further research in the Hagenbeck archives in Hamburg or in historical newspapers of the Hanseatic city and elsewhere could possibly provide answers.
A search in the database of the herpetological collection reveals that the two Indian gharials in the Natural History Museum in Vienna are not the only specimens that come from the Hanseatic animal trade companies Umlauff and Hagenbeck. While the name "Hagenbeck" is noted only 22 times under origin or collector, there are over 250 specimens in the collection with the indication "Umlauff". However, the names of the actual animal trappers and buyers, of whom Jürgen Johansen was probably one of the most successful (see above), are only mentioned in very few cases; the geographical origin of the specimens is also usually only given at country level, which reduces their scientific value. Especially descriptions of new species based on voucher specimens without a precise and traceable locality can cause problems for later research and possible protection of the species (see e.g., Koch, C. et al. 2019). Presumably, the other vertebrate departments and exhibition areas of the Natural History Museum also hold further specimens that originally arrived in Vienna from all over the world via Hamburg. It is to be hoped that their provenance is better documented than that of the two large Indian gharials, whose origin we were able to clarify here by a lucky coincidence. Thus, these two special crocodile specimens exemplify the close international ties between the Natural History Museum Vienna and natural history dealers such as the two Hanseatic firms of Umlauff and Hagenbeck in the late 19th and early 20th centuries.

Acknowledgements

We are indebted to Nigel T. Rothfels (Milwaukee) for helpful contacts in the search for information on Jürgen Johannsen and for sharing photos of Hagenbeck's historical account books with us, for which Hermann Reichenbach (Tierpark Hagenbeck Archive, Hamburg) kindly gave permission to use. We thank Britta Lange (Berlin) for the interesting reference to two further gharial hides in the unpublished memoirs of Johannes Umlauff in the Hagenbeck archives. Susanne Köstering (Berlin) and Jakob Hallermann (Hamburg) kindly gave us hints for the search for information on the unknown draughtsman

Ewald. We are indebted to Hilke Thode-Arora (Munich) for literature on Carl Hagenbeck and to Clemens Radauer (Vienna) and Klaus Gille (formerly Tierpark Hagenbeck Archive, Hamburg) for further information about Jürgen Johannsen. The late Mr. Gille also kindly made digital copies from Johannes Umlauff's unpublished manuscript for us. Likewise, Leonie Kircher (Berlin), Yvonne Reimers (Berlin), and Catharina Winzer (Hamburg) were helpful in finding a photograph of Johannes Umlauff. Linda Mogk, Joachim Scholz, and Udo Becker (all from Frankfurt), Wolfgang Böhme (Bonn), Alexandru Iftime and Tiberiu Sahlean (both Bucharest), Mario-Dominik Riedl (Vienna), Annett Heine (Dresden Zoo), as well as Annemarie Ohler and Jérôme Courtois (both Paris) actively supported us with literature references as well as photos and information about the gharial hides in the respective museum collections. Alice Schumacher (NHMW) kindly took photos of the two Viennese Indian gharials. Melina Haring and Robert Illek (both NHMW) are thanked for their help in measuring the two exhibits. Access and support to sources from the NHMW's Archive for the History of Science was kindly provided by Andrea Zaremba and Martin Krenn. We thank Aaron Bauer (Villanova) for pointing out a large specimen at Yale Peabody Museum to us, of which Gregory J. Watkins-Colwell (New Haven) kindly provided photos and information. We thank David Dickey and David Kizirian (both New York) for information about gharial specimens under their care and Rachunliu G. Kamei and Joshua Mata (both Chicago), Lauren Scheinberg (San Francisco), and Jennifer Sheridan (Pittsburgh) for their replies to our requests. In addition, we would like to thank Sandra Miehlbradt (formerly of the Museum für Naturkunde Berlin) for providing us with the Umlauff documents from the museum's historical department. Finally, helpful comments that improved the current manuscript were kindly made by David Blackburn.

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International Society for the History and Bibliography of Herpetology

Bibliotheca Herpetologica

Bibliographica Herpetologica – Updates on "How to Raise a Bullfrog" and "Snakes in a Grave"

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Dodd, C.K., Jr., and M.R. Jennings. 2021. How to Raise a Bullfrog – The Literature on Frog Farming in North America. *Bibliotheca Herpetologica* 15(8):77-100.

Since this paper was published, I have received another instruction booklet on how to raise American Bullfrogs for profit. The booklet, *The Practical and Profitable Industry of Frog Farming,* was published by William (Bill) R. Doughty (22 January 1931 – 21 July 2008), owner of the Old Southern Frog Farms of Evansville, Indiana. The stapled booklet consists of 10 pages of instructions on how to raise bullfrogs commercially, plus a price list. The text is double-spaced, and the booklet contains nine black and white photos illustrating the equipment needed and methods for raising frogs. As in some other manuals, the emphasis is on building and stocking a pond, screening it to prevent escape, preventing predation, and letting the frogs do the rest. Chicken and fish scraps, and even soybean meal, were suggested as useful to draw in insects to serve as food for the frogs. The problem of Red Leg (*Aeromonas*) is discussed with the then known treatments (antibiotics, 0.15% sodium chloride, putting copper pennies in the pond). Doughty sold frogs and crawfish (as a special starter offer) for $25.00. The booklet is undated. The Old Southern Frog Farm advertised in numerous magazines (e.g., Field & Stream, May 1970, p. 190). Mr. Doughty moved to Wyoming in 1974, so the booklet probably dates to the early 1970s.

In a further note, a second copy of *American Frog Raising* by Roy W. Mabie, 1936, is known from the Bolger Heritage Center, Ridgewood Public Library, Ridgewood, New Jersey (Deborah Alejandra Popowski, Ridgewood Public Library, personal communication, 2 December 2021).

Dodd, C.K., Jr. 2023. Snakes in a Grave – or Not. *Bibliotheca Herpetologica* 17(1):1-7.

I have recently acquired a second version of the 1930s folded pamphlet entitled *Snakes in an Atheist's Grave*. This is a much newer version, published on better paper, and it is smaller than the original (12.8 x 17 cm unfolded vs. 15 x 17 cm unfolded). Although the text is the same, there are only

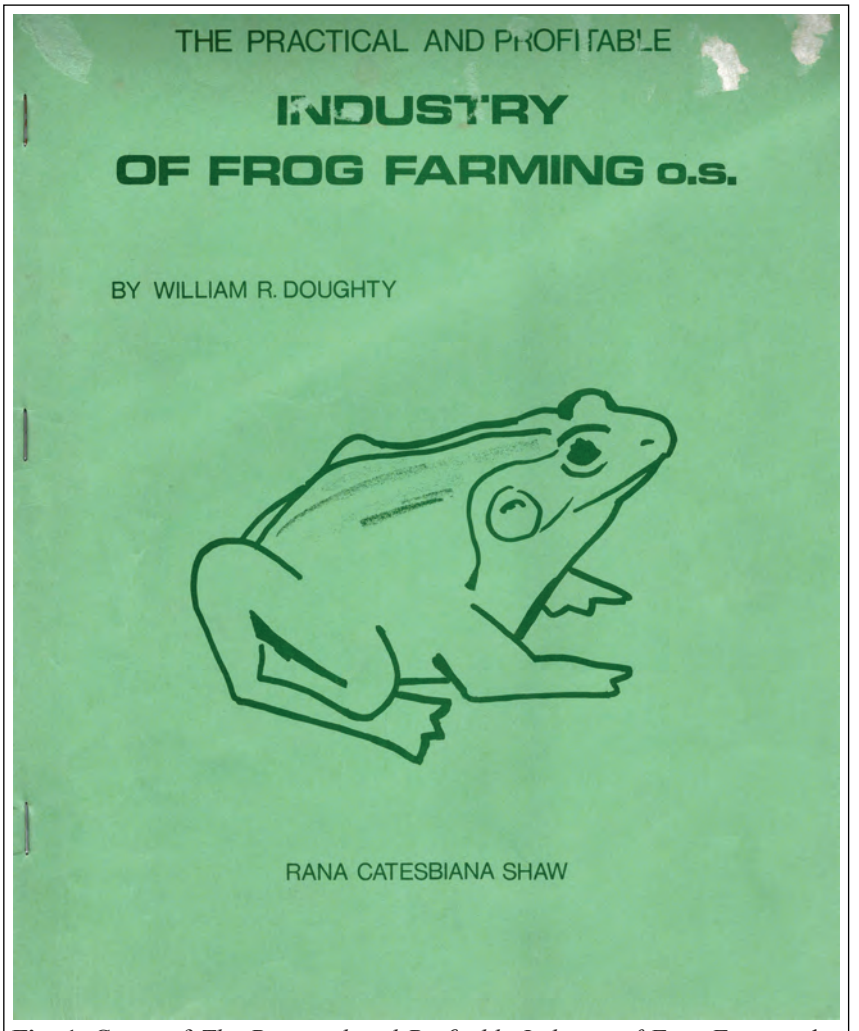

Fig. 1. Cover of *The Practical and Profitable Industry of Frog Farming* by William R. Doughty. Author's collection.

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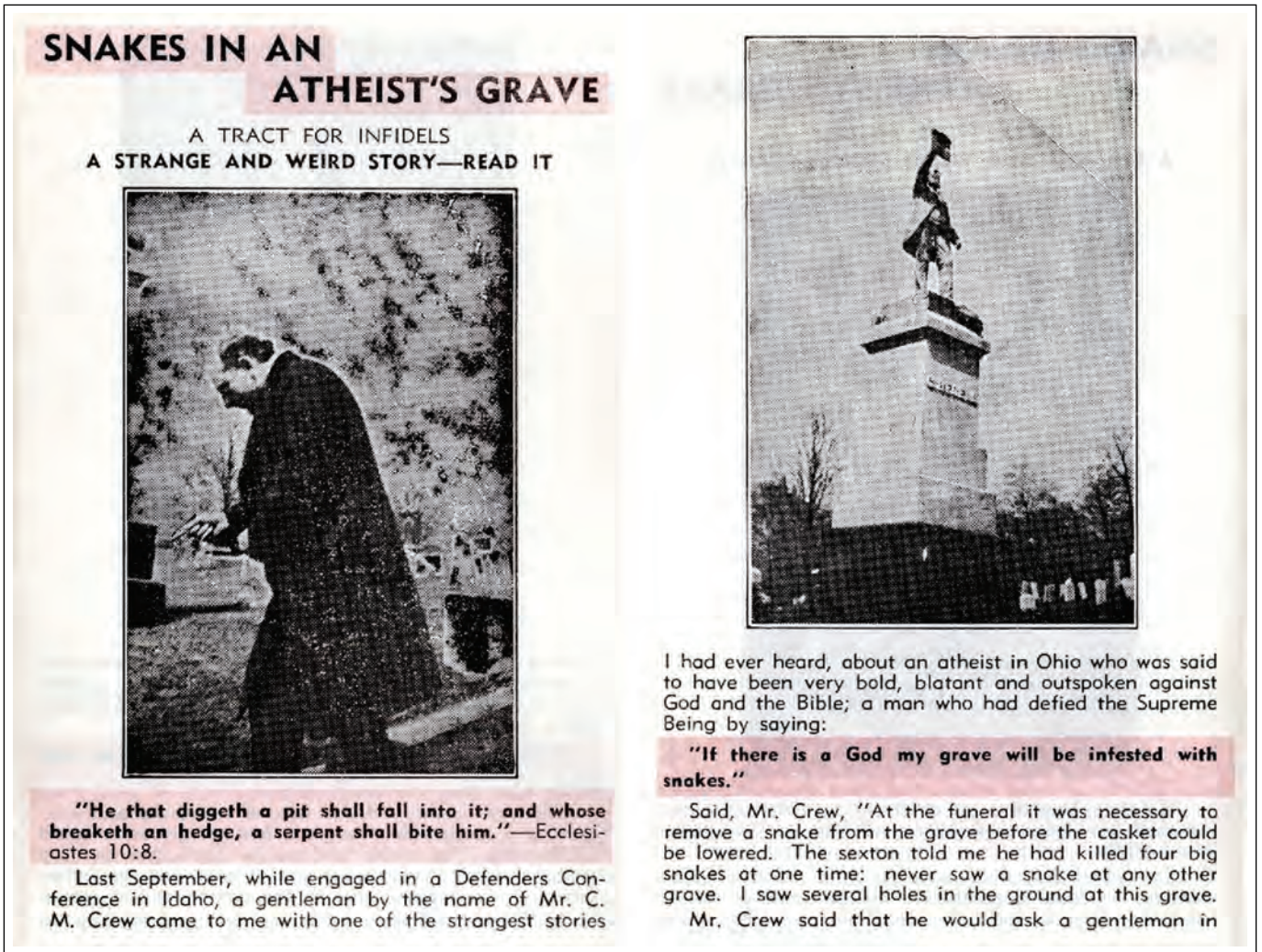

SNAKES IN AN ATHEIST'S GRAVE

A TRACT FOR INFIDELS

A STRANGE AND WEIRD STORY—READ IT

"He that diggeth a pit shall fall into it; and whose breaketh an hedge, a serpent shall bite him."—Ecclesiastes 10:8.

Last September, while engaged in a Defenders Conference in Idaho, a gentleman by the name of Mr. C. M. Crew came to me with one of the strangest stories I had ever heard, about an atheist in Ohio who was said to have been very bold, blatant and outspoken against God and the Bible; a man who had defied the Supreme Being by saying:

"If there is a God my grave will be infested with snakes."

Said, Mr. Crew, "At the funeral it was necessary to remove a snake from the grave before the casket could be lowered. The sexton told me he had killed four big snakes at one time: never saw a snake at any other grave. I saw several holes in the ground at this grave.

Mr. Crew said that he would ask a gentleman in

Fig. 2a. *Snakes in an Atheist's Grave*, Gospel Tract Society, Independence, Missouri. Author's collection.

two photos, omitting the North Benton, Ohio, Presbyterian Church. This small tract was published by the Gospel Tract Society of Independence, Missouri. Although undated, the use of a zip code means it was published after July 1963.

We suggest the following format for citing this article:
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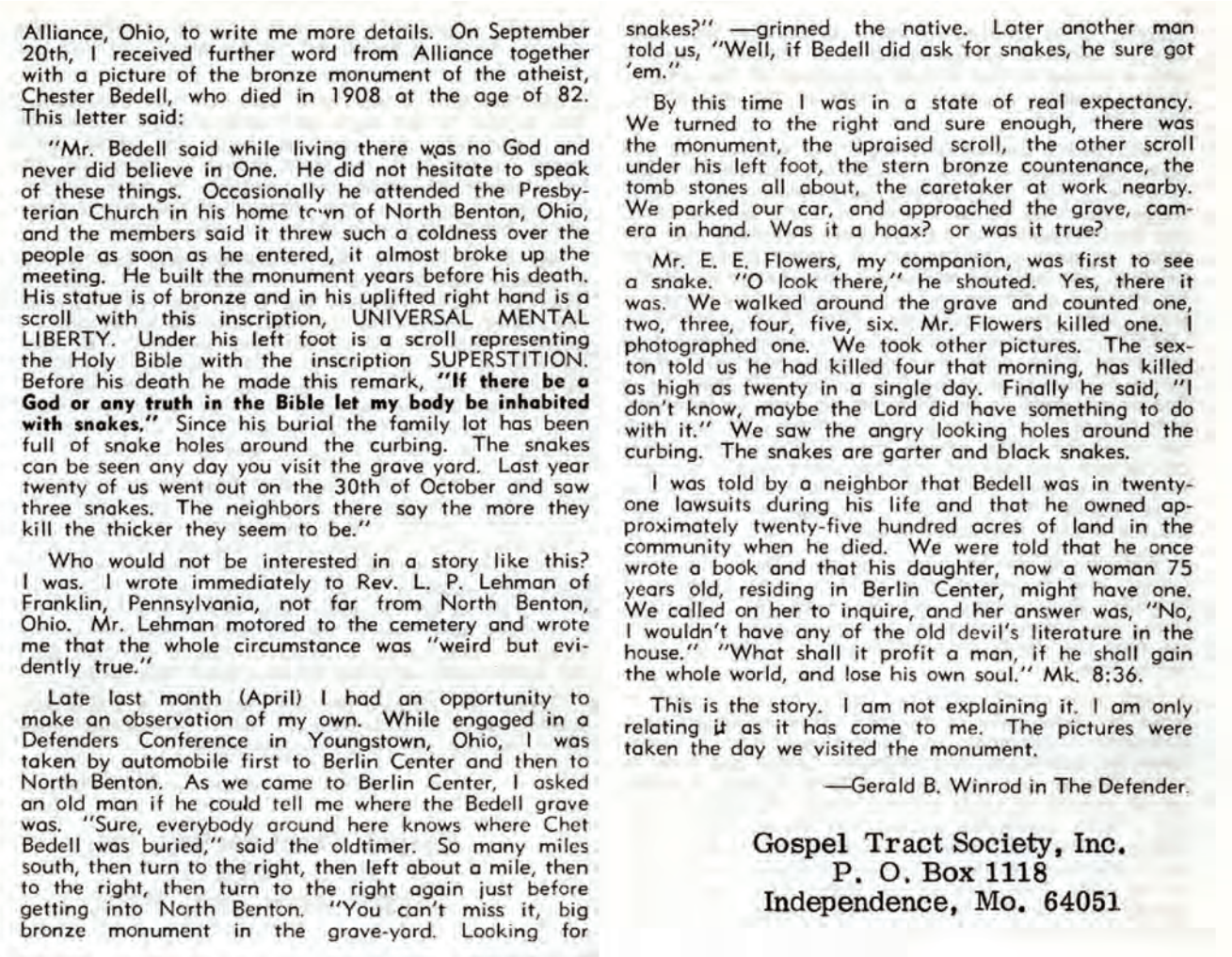

Alliance, Ohio, to write me more details. On September 20th, I received further word from Alliance together with a picture of the bronze monument of the atheist, Chester Bedell, who died in 1908 at the age of 82. This letter said:

"Mr. Bedell said while living there was no God and never did believe in One. He did not hesitate to speak of these things. Occasionally he attended the Presbyterian Church in his home town of North Benton, Ohio, and the members said it threw such a coldness over the people as soon as he entered, it almost broke up the meeting. He built the monument years before his death. His statue is of bronze and in his uplifted right hand is a scroll with this inscription, UNIVERSAL MENTAL LIBERTY. Under his left foot is a scroll representing the Holy Bible with the inscription SUPERSTITION. Before his death he made this remark, **"If there be a God or any truth in the Bible let my body be inhabited with snakes."** Since his burial the family lot has been full of snake holes around the curbing. The snakes can be seen any day you visit the grave yard. Last year twenty of us went out on the 30th of October and saw three snakes. The neighbors there say the more they kill the thicker they seem to be."

Who would not be interested in a story like this? I was. I wrote immediately to Rev. L. P. Lehman of Franklin, Pennsylvania, not far from North Benton, Ohio. Mr. Lehman motored to the cemetery and wrote me that the whole circumstance was "weird but evidently true."

Late last month (April) I had an opportunity to make an observation of my own. While engaged in a Defenders Conference in Youngstown, Ohio, I was taken by automobile first to Berlin Center and then to North Benton. As we came to Berlin Center, I asked an old man if he could tell me where the Bedell grave was. "Sure, everybody around here knows where Chet Bedell was buried," said the oldtimer. So many miles south, then turn to the right, then left about a mile, then to the right, then turn to the right again just before getting into North Benton. "You can't miss it, big bronze monument in the grave-yard. Looking for snakes?" —grinned the native. Later another man told us, "Well, if Bedell did ask for snakes, he sure got 'em."

By this time I was in a state of real expectancy. We turned to the right and sure enough, there was the monument, the upraised scroll, the other scroll under his left foot, the stern bronze countenance, the tomb stones all about, the caretaker at work nearby. We parked our car, and approached the grave, camera in hand. Was it a hoax? or was it true?

Mr. E. E. Flowers, my companion, was first to see a snake. "O look there," he shouted. Yes, there it was. We walked around the grave and counted one, two, three, four, five, six. Mr. Flowers killed one. I photographed one. We took other pictures. The sexton told us he had killed four that morning, has killed as high as twenty in a single day. Finally he said, "I don't know, maybe the Lord did have something to do with it." We saw the angry looking holes around the curbing. The snakes are garter and black snakes.

I was told by a neighbor that Bedell was in twenty-one lawsuits during his life and that he owned approximately twenty-five hundred acres of land in the community when he died. We were told that he once wrote a book and that his daughter, now a woman 75 years old, residing in Berlin Center, might have one. We called on her to inquire, and her answer was, "No, I wouldn't have any of the old devil's literature in the house." "What shall it profit a man, if he shall gain the whole world, and lose his own soul." Mk. 8:36.

This is the story. I am not explaining it. I am only relating it as it has come to me. The pictures were taken the day we visited the monument.

—Gerald B. Winrod in The Defender.

Gospel Tract Society, Inc.
P. O. Box 1118
Independence, Mo. 64051

Fig. 2b. *Snakes in an Atheist's Grave*, Gospel Tract Society, Independence, Missouri. Author's collection.

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The horns of horned lizards (Phrynosomatidae: *Phrynosoma*): the long road to their conceptualization as unique lacertilian features with individual identity

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Abstract. Lizards of the genus *Phrynosoma* are distinguished from all other lizards by the presence of an array of cranial horns, but until recently, these have largely been considered to be homologous only in the aggregate. The terminology used to denote them in the descriptive literature has been inconsistent and not based upon a common definition for these structures. Here we review the terminology applied to the cranial asperities of the species of *Phrynosoma*, from their first published description to the present day. Early authors noted the presence of "bristles", "prickles", "spines", "horns", "tuberculous knobs", "tubercles", "points", "thorny eminences", "stings", "thorn-shaped projections" and "quills". Later descriptions used the terms "tubercles", "protuberances", "bony processes", "horns", "spines", "tuberosities", and "rugosities", at times interchangeably, but there continued to be no generally agreed-upon definition for the asperities to which these terms were applied. A consistent naming scheme for the horns of the species of *Phrynosoma* is necessary for the formulation and testing of hypotheses of horn homology among its species, and for further investigation of the evolution of these unique features.

Introduction

Elongated projections called "horns", usually adorning the head but, in some taxa, other parts of the body, are widespread among the Animalia (Geist, 1966; Emlen, 2008; Hall, 2015). The Oxford English Dictionary (2nd Ed: 1989) provides two definitions for horns, one applicable only to ruminant mammals, the other referring to structures of multiple developmental derivations, functions and appearances, found on the heads of a wide range of animal taxa (Simpson and Weiner, 1989). Under both definitions they are unbranched and non-deciduous (Hall, 2015).

The iguanian lizard genus *Phrynosoma* is unique among the Lacertilia in bearing pointed projections arising from the margins of the parietal, squamosal and frontal bones of the dermatocranium (Duméril and Bocourt, 1874; Cope, 1892; Bryant, 1911; Smith, 1946; Reeve, 1952; Jollie, 1960; Etheridge, 1964; Jenkins and Tanner, 1968; Presch, 1969; Montanucci, 1987; Baur and Montanucci, 1998; Sherbrooke, 2003; Evans, 2008; Bergmann and Berk 2012; Powell and Russell 2023). For the purposes of this review, we use the term "asperities", defined more generally as "sharp, rough, or rugged excrescences" (Simpson and Weiner, 1989), as a collective term for the projections arising from the dermatocranial bones of *Phrynosoma*. The historical literature is replete with a variety of labels for these structures (see below), and a general term applicable to all of them allows comparison between the descriptions of various authors.

Although dermatocranial bony processes are found in other lacertilian groups (Rand, 1961; Rieppel and Crumly, 1997; Lang, 1989; Townsend and Larson, 2002; Evans, 2008; Taylor et al., 2017; reviewed in Powell and Russell, 2023), none are demonstrably homologous to those found in *Phrynosoma*. While many lacertilian species bear cranial ornamentation (e.g. Ord and Stuart-Fox, 2006; Rodda, 2020), these are generally integumentary in origin and not comparable to the asperities displayed among the species of *Phrynosoma*.

The morphological and other parallels between the agamid *Moloch horridus*, an exceedingly spinose species, and *Phrynosoma* have frequently been noted (Pianka and Pianka, 1970; Pianka and Parker, 1975; Sherbrooke, 2003). The dorsal surface of *Moloch*'s parietal bears paired bosses, closer to the anterior than to the posterior margins of the bone (Bell et al., 2009). These are associated with the bases of two superficial horns, but do not extend into these horns (http://digimorph.org/specimens/Moloch_horridus/head/); their position suggests that they cannot be considered homologues of the structures exhibited by *Phrynosoma*. The remaining asperities borne by *Moloch* are integumentary in origin, lacking bony support (Owen, 1881; Bell et al., 2009).

Collectively (although without precise definition) the major dermatocranial asperities characteristic of *Phrynosoma*

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are regarded as an autapomorphy of *Phrynosoma* (Etheridge and de Queiroz, 1988), and occur in all species, although with varying degrees of expression (Reeve, 1952; Presch, 1969; Montanucci, 1987; Baur and Montanucci, 1998; Sherbrooke, 2003; Leaché and McGuire, 2006; Bergmann and Berk, 2012). Their possession, in a colloquial rather than anatomical sense, constitutes one part of a suite of morphological and physiological peculiarities exhibited by *Phrynosoma* (Pianka and Parker, 1975; Sherbrooke, 2003), and they have attracted much attention (Reeve, 1952; Presch, 1969; Pianka and Parker, 1975; Montanucci, 1987; Norell, 1989; Baur and Montanucci, 1998; Sherbrooke, 2003). The terminology used to refer to these cranial projections has, however, been historically inconsistent, with no generally agreed-upon definition of what "horns" actually are. The plethora of terms used, the general disregard (with some exceptions) paid to their precise anatomical location, a tendency to describe their external, as opposed to internal, anatomy, and the frequent application of different terms to the same structures have all contributed to the difficulty of assessing their comparative expression and distribution between species. As Mabee et al. (2020) point out, use of the same name for two different structures can imply homology, and consequent assumptions based upon this implication obscure our understanding of evolutionary relationships. The lack of a distinction between "horns" *sensu stricto* and other cranial asperities (defined as rough excrescences [Simpson and Weiner, 1989] arising from the dermatocranial bones) in *Phrynosoma* has hindered understanding of the evolution of the complex of morphological and behavioral defences its species exhibit (Pianka and Parker, 1975; Sherbrooke, 2013). Identification of true homologues among the variety of dermatocranial asperities exhibited by *Phrynosoma* is key to understanding the evolution of its cranial ornamentation (Montanucci, 1987; Bergmann and Berk, 2012; Powell and Russell, 2023). In our exploration of this issue, we investigated whether the homology of individual asperities between species could be established (Powell and Russell, 2023). This required us to assess how they have been previously regarded by those working on *Phrynosoma* and how they have been incorporated into attempts to understand comparative aspects their evolution and behavior.

Prior to the 20th century many alternate terms for the cranial asperities of *Phrynosoma* were employed. Most frequently "spines" was employed (used in at least 20 publications), followed by "horns" (8), prickles (3), tubercles (3), points (2), tuberculous knobs (2), thorny eminences (2), stings (1), bristles (1), thorn-shaped projections (1) and quills (1). In many publications more than one term is used and it is evident that, although these cranial ornamentations were regarded as a suite of similar attributes, their anatomical nature was generally (with a few exceptions) not of paramount concern.

In the 20th and 21st centuries the number of terms applied diminished. "Horns" has been employed most frequently as a descriptor (in at least 32 publications), closely followed by "spines" (28), these two terms often being used interchangeably in the same publication. Less frequently employed terms are tubercles (8), tuberosities (4), protuberances (1), bony processes (1) and rugosities (1). With the passage of time there has been a greater attempt to anatomically circumscribe them. Regardless, many authors still used different terms interchangeably, thereby confounding comparative assessment of their distribution and expression among taxa.

We recently (Powell and Russell, 2023) refined our understanding of the anatomical form and disposition of these asperities on individual cranial elements and defined the horns of *Phrynosoma* as follows: "any marginal dermatocranial asperity that: (a) is as long as, or longer, than its basal width; (b) arises from the lateral, posterolateral or posterior margin of its bone of origin; (c) is pointed at its apex (in early ontogenetic stages, at least); (d) is round or elliptical in cross-section, with the major axis of the ellipse paralleling the lateral or posterior margin of its bone of origin and (e) is externally clad in a keratinous sheath that is either unfaceted, longitudinally grooved, or longitudinally keeled". Powell and Russell (2023), furthermore, were able to identify a plesiomorphic array of horns, borne by the squamosals and parietal, exhibited by all extant members of the genus. Accordingly, horns are distinguishable from other protuberances on the phrynosome dermatocranium. The interspecific disparity in *Phrynosoma* horn development (Bergmann and Berk, 2012; Powell and Russell, 2023; Fig. 1) suggests a complex evolutionary history for these structures. Without confidence in the determination of phylogenetic homologies among the dermatocranial horn array, the formulation and testing of hypotheses concerning its evolution becomes more tenuous.

Much of the earlier descriptive literature about *Phrynosoma* is in languages other than English, and the words used to refer to cranial asperities can be translated in more than one way. In such cases, we employ the equivalent English word most consistent with zoological anatomy.

Along with written statements, vague or otherwise, about the head ornamentation of *Phrynosoma*, illustrations have been instrumental in establishing a general impression of this complex and the extent of its expression in its various species. Figures of phrynosomes, or localized parts of their bodies, have contributed greatly to the characterization of their cranial armature. Tracing the history of these illustrations, along with the associated verbal descriptions, indicates how the cranial asperities have become an increasingly focal part of the appreciation of variation within the genus and thus in discrimination between species.

Herein we document how the cranial asperities of *Phrynosoma* have been treated by authors writing about horned lizards over the last 362 years. We review pertinent accounts of *Phrynosoma* in chronological order, examining the terminology applied to their head ornamentation. We consider when and how such asperities have been employed as characters for distinguishing between species, and when interspecific homology of such asperities is, or appears to be, assumed.

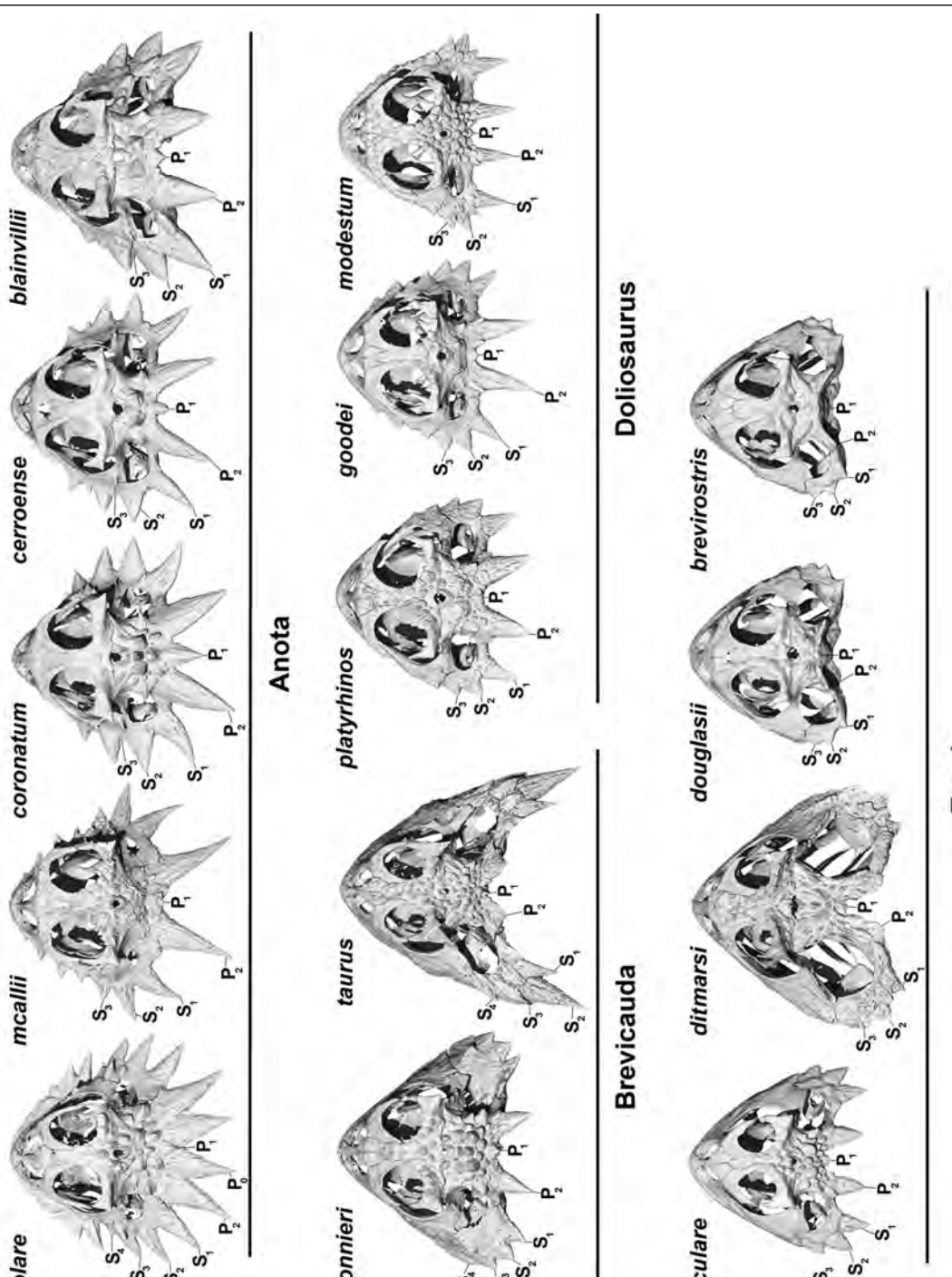

Fig. 1. Dorsal aspects of μ-CT scans of all species of *Phrynosoma*, with the exception of *P. sherbrookei* and *P. ornatissimum*, illustrating the disparity of dermatocranial and horn anatomy in this genus. Species grouped by crown clades of Leaché and McGuire (2006); horizontal black lines indicate clade membership. Horns labelled using Powell et al.'s (2002) terminology to indicate interspecific homologies as determined by Powell and Russell (2023); S indicates horns arising from the squamosal, P indicates horns arising from the parietal. All specimens scaled to common distance between anterior tip of premaxilla and anterior margin of parietal foramen. *P. asio* – California Academy of Sciences (CAS) 132556, *P. solare* – University of Michigan (UM) 67327, *P. mcallii* – CAS 223630, *P. coronatum* – CAS 143855, *P. cerroense* – University of California Museum of Vertebrate Zoology (UCMVZ) 182256, *P. blainvilli* – University of Arizona (UAZ) 43866, *P. cornutum* – Texas Cooperative Wildlife Collection (TCWC) 30989, *P. braconnieri* – University of Texas Collection of Vertebrates (UTACV) 11392, *P. taurus* – UTACVR 19393, *P. platyrhinos* – California Academy of Sciences (CAS) 37677, *P. goodei* – CAS 229922, *P. modestum* – TCWC 43872, *P. orbiculare* – TCWC 54228, *P. ditmarsi* – UAZ 32354, *P. douglasii* – United States National Museum (USNM) 111352, *P. brevirostris* – University of Alberta (UA) 280. Modified from Powell and Russell (2023).

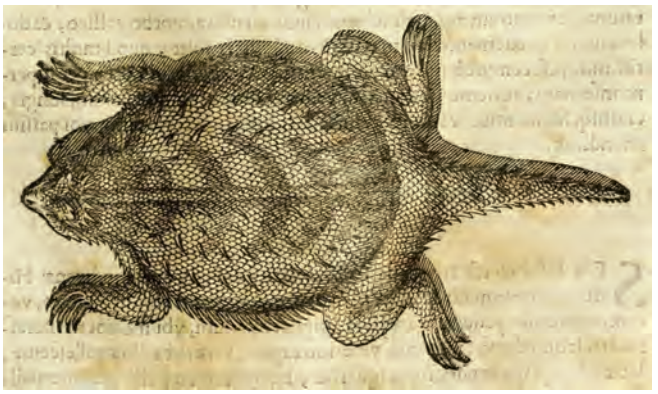

Fig. 2. Illustration of the dorsal aspect of *Phrynosoma orbiculare* from Hernandez (1651). Note the "garland" of "points" or "prickles" arising from the posterior of the head. Getty Research Institute, Los Angeles (93-B9305)

Seventeenth Century

Hernandez (1651) presented what is apparently the oldest published reference to a species of *Phrynosoma* (considered to be *P. orbiculare*). He characterized the head as "the hardest" [part of the body] (*sed caput est durissimum*) and made reference to cranial projections – "*horrens que aculeis corollae modo dispositis*" ("the points (prickles, stings – Morwood, 2005) of the garland, which are disposed in a horrible way"). Hernandez's (1651) figure of the dorsal aspect of *P. orbiculare* (Fig. 2) shows an arc (evidently the "garland") of eight asperities arising from the posterodorsal region of the head, one of which appears to be median (thus rendering the garland asymmetrical), as well as superocular asperities. The "prickles" are not visually differentiated from those fringing the lateral aspects of the trunk and tail.

Eighteenth Century

Seba (1734) depicted three different lizards under the name "*Tapayaxin*", but only that shown in Tabula 109, Fig. 6 appears to represent a phrynosome. He made no reference to cranial asperities in his description of "*Bufo Americanus*", which he also identified as "*Tapayaxin*", and his depiction (Fig. 3), while evidently of *Phrynosoma orbiculare*, does not feature such structures. He did state, however, that the entire surface of the dorsum of the body is covered with "*aculeis"* (stings, prickles, points – Morwood 2005) although he failed to illustrate any of them. The lizard depicted in Seba (1734; Tabula LXXXIII Figs. 1, 2) does not resemble *P. orbiculare*, although Seba's (1734) discussion of this illustration refers to the species described by Hernandez (1651).

Laurenti (1768) noted dorsal asperities for *Cordylus orbicularis* (= *Phrynosoma orbiculare*) "*corpus squammis carinatus, carinis elevatissimum* ("body with keeled scales, elevated") and characterized the head as "mailed" ("*caput cataphractum"*).

Fig. 3. Illustration of "*Bufo Americanus*" or *Tapayaxin* (*Phrynosoma orbiculare*), from Seba (1734). Not in Copyright.

Clavigero (1780), evidently referring to the same species as Hernandez (1651), also noted its very hard head, but said nothing about cranial asperities. His figure depicting *Phrynosoma orbiculare* is very similar to that of Hernandez (1651). Unlike the latter, however, he inferred, through illustrative differentiation, that the ornamentation on the cranial occipital region differs qualitatively from that on the trunk, limbs and tail. His figure is suggestive that they are an integral part of the structure of the head rather than merely superficial integumentary embellishments. Nine posterior cranial asperities are depicted, one of which is median.

Nineteenth Century

Daudin (1802), discussing *Les Agames orbiculaires* (*Phrynosoma orbiculare*), stated that "*le sommet de la tête est entièrement gonflé, dur, élargi, et parsemé des petites épines, sur-tout vers l'occiput*." ("The top of the head is completely swollen, hard, enlarged, and dotted with small spines, mostly towards the occiput."). In contrast to Clavigero (1780) and in accord with Seba (1734), he illustrated it as lacking spine-like ornamentation anywhere on the head or body. The illustrated specimen has the same general orientation as that presented by Seba (1734) and may have been adapted from it.

Oken (1816) briefly considered *Agama orbicularis* (= *Phrynosoma orbiculare*) and *A. plica* (= *Plica plica*), which he grouped under Tapaja (Oken's terminology for this taxon is unclear – Reeve 1952). While no cranial asperities were noted for *A. orbicularis*, Oken (1816) listed, among the attributes of *A. plica*, "*…Hinterhaupt schwielig, jederseits dornige Borbeln… Nacken etwas gezähnelt.*." (""[...] Back of the head calloused/uneven, thorny eminences on both sides … back of the head somewhat serrated "), a description more applicable to *P. orbiculare* than to the tropidurid *Plica plica*, as is "*hat aber deutliche Rägel*" ("has distinct spines").

Phrynosoma cornutum was first formally described as *Agama cornuta* by Harlan (1825), who noted of the "occiput" that "… the posterior margin…is furnished with from four to six spines or horns", of varying length. He also noted that the "horns" of this species are similar to, but longer than, those of *P. orbiculare*, which he referred to as "spines", this being suggestive that he saw some commonality between them.

Fig. 4. Illustration accompanying first description of *Agama douglassii* (= *Phrynosoma douglasii*) from Bell (1829). Public Domain.

This is the first use of the term "horns" (in any language) in reference to the dermatocranial asperities of *Phrynosoma*.

In describing *Agama* (=*Phrynosoma*) *douglassii* Bell (1829) noted that the dorsum is covered with "…small raised scales, interspersed with larger ones which are aculeated, and most of them quadrangular. These form distinct ridges over the eyes, above the ears, across the occiput, and along the sides of the body and tail.". In so doing, he failed to distinguish between cranial asperities and the large epidermal scales covering the dorsum and fringing the body and tail. Bell (1829) was the first to depict (Fig. 4) a phrynosome in lifelike pose bearing body and head ornamentation, rendering the animal closer to its actual appearance than previous stylized efforts. In this figure the oto-occipital ornamentation is clearly evident as being distinct from the other cranial embellishments, although nothing is suggestive that the occipital asperities differ in their underpinnings from those along the margins of the flanks.

Sonnini and Latreille (1830) noted, among the distinctive characteristics of *Lacerta orbicularis*, Lin. (= *Phrynosoma orbiculare*), which they name *Stellio orbiculaire*, "*le dos et le sommet de la tête garnis d'aspérité*s" ("the back and the top of the head furnished with asperities"). They go on to note "[…] *son corps ramassé et parsemé en dessus des piquants* […]" ([…]its body scattered on top with prickles […]"). Their figure (Pl. 16, 3) strongly resembles Seba's (1734) depiction of the "*Tapayaxin*" and is likely based upon it.

Griffiths and Pidgeon (1831), in their rendition of Cuvier's *Regne Animal*, note of "*lacerta orbicularis*" (Orbicular Lizard) that the "occiput is furnished with small spines", likening these to those found on the back and tail. Their illustration is of *Agama cornuta* (= *Phrynosoma cornutum*), however, and they depict the horns of this species with fidelity, stating that Cuvier considered this to be the same species as *L. orbicularis*. No attempt, thus, was made to distinguish the two species on the basis of their cranial armature.

Wagler (1833) regarded the "eight occipital horns" ("*occipite cornubus octo*") of *Phrynosoma orbiculare* as a key character; this was later expanded to "*in occipite et temporum lateribus series cornuum osseorum octo, retroversorum, conicorum.*" ("a series of bony horns on the occiput and temporal, conical…"). With reference to *P. orbiculare* he clearly delineated the asperities on the cranial oto-occipital region as standing proud of the nuchal region and projecting posteriorly over the neck. Wagler (1833) was the first to characterize these structures as having bony cores and his illustration (Fig. 5) renders them topographically and structurally different from other scaly projections on the head and body (flanks, thighs and tail). In this figure, the number of horns differs from that given in the text.

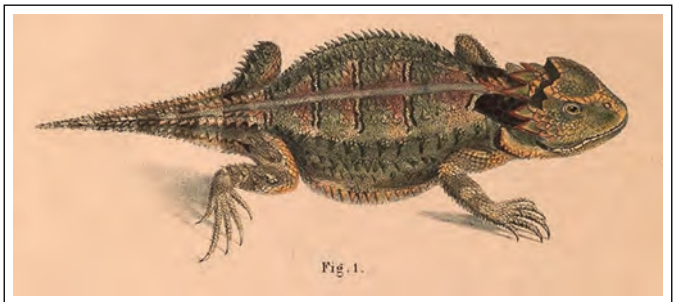

Fig. 5. Wagler's (1833) illustration of *Phrynosoma orbiculare*. Public Domain.

Weigmann (1834), in his general consideration of the genus *Phrynosoma*, noted of the head: "*in occipite temporibusque depressis spiniferum*" ("bears spines on the depressed occiput and temporals."), and is "*spinarum validarum corona cinctum*" ("bordered by a crown of strong spines"). He expands upon this: "*Id enim, ut nimia brevitate atque latitudine, ita maxime prominentiis octo aculeiformibus excellit, quorum ternae utrinque ex osse temporali semicirculari, binae ex osse parietali brevi, lato orientur. Os frontale intermedium postice hamum utrinque, supra orbitam curvatum, atque os orbitale posterius excipientem emittens"* ("For this [structure of the head] … so also rises greatly with eight thorn-shaped projections, which spread widely in threes on both sides from the semicircular temporal bone, and in pairs from the short parietal bone. The intermediate frontal bone posteriorly bears a hook on both sides above the curved orbital"). In his consideration of *P. orbiculare*, he noted that ""*occiput ac tempora depressa atque aculeis validis, conicis, osseis, (in occipite binis, in temporibus ternis) armata, clypeolis prominulis exasperantur, quorum tubercula duo semer ante aculeos occipitales, tertium inter hos ipsos aculeos, inveniuntur.*." ("The occiput and temporals are depressed and are equipped with strong, conical, bony spines [in pairs on the occiput, in threes on the temporals], they are roughened by small, slightly projecting shields, of which two small protuberances are always found in front of the occipital points, and a third between these points."), again referring to bony hornlike asperities on the squamosal and the occipital, with a possible reference to a third such between the two more strongly-developed structures on the occipital. He went on to note "*Numerum formamque horum aculeorum in omnibus (triginta circiter), quae vidi, exemplis semper sibi constantum invenerim,*" ("Since I find the number and shape of these points among all samples (approximately 30) to always

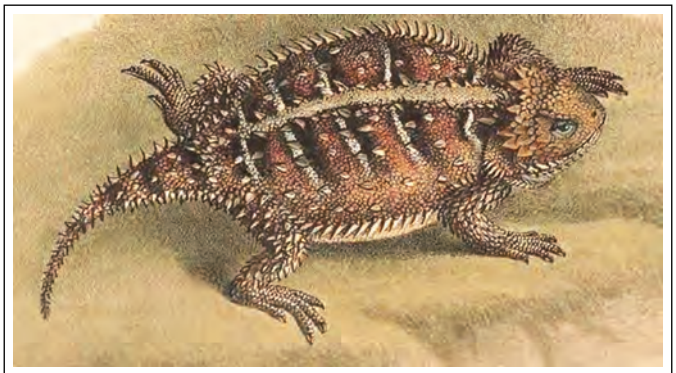

Fig. 6. Illustration of *Phrynosoma orbiculare* from Wiegmann (1834), accurately depicting the morphology and number of the horns. Public Domain.

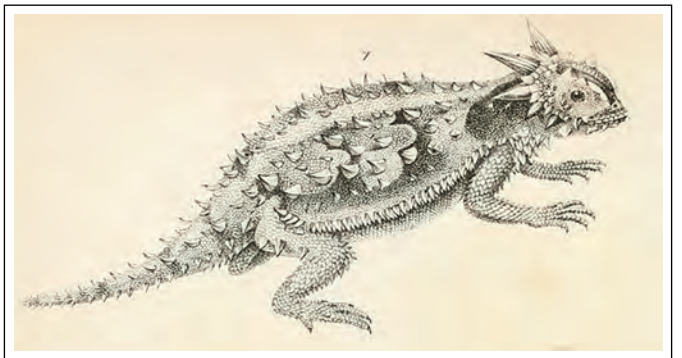

Fig. 7. Illustration of *Phrynosoma coronata* (= *P. blainvillii*) from Blainville's (1835) description. The dorsal keeled scales are clearly differentiated from the cranial horns. Not in Copyright.

be consistent to themselves, I have no doubt that a specific character is indicated by this..."), suggesting that he regarded the number and placement of these asperities to be a species-specific character for *P. orbiculare*. He differentiated them, in his depiction, both anatomically and positionally, from other spine-like projections on the head and body. Weigmann (1834), like Wagler (1833), clearly indicates that the cranial horn array overhangs the nuchal region (Fig. 6).

Blainville's (1835) description of *Phrynosoma coronata* (= *P. coronatum*) included details about its cranial armature: "*Elle est hérissée d'épines comprimées, un sur chaque sourcil, cinq de long de chaque branche de lar màchoire inférieure, quatre de long de l'arcade zygomatique, et qui, en se joignant à deux grandes occipitales, constituent une sorte de couronne, entourant obliquement les deux tiers postériuers de la tête.*" ("It is bristling with compressed spines, one on each eyebrow, five long ones on each branch of the lower jaw, four long ones on the zygomatic arch, which, joining with two large occipitals, form a sort of crown, obliquely encircling the posterior two-thirds of the head."). He thus distinguished the asperities ("*épines*") arising from the squamosal ("zygomatic arch") from those arising from the parietal ("*occipitales*"). He was the first to illustrate a species of *Phrynosoma* (*P. coronatum*) with a highly conspicuous array of elongated, attenuated cranial projections extending far over the dorsal and lateral aspects of the nuchal region. For the largest of these, the distinctive and characteristic longitudinal fluting on their epidermal cladding is clearly shown. The complete distribution of the cranial asperities is characterized and depicted via multiple views of the head as well as through whole body renderings. No indication is given, however, as to which cranial asperities incorporate bony cores and which do not.

In their general consideration of the genus *Phrynosoma*, Duméril and Bibron (1837) noted "*Tête court, arrondie en avant, bordée postérieurement et latéralement de grandes et fort piquants*" ("Short head, rounded in front, bordered posteriorly and laterally by large and strong prickles"), expanding upon this by mentioning "*Le derrière de la tête des Phrynosomes est bordé, d'une oreille de l'autre; d'un rang des écailles redressées, ou même de longs et gros piquans simulant un espèce de couronne*." ("The back of the head of phrynosomes is rimmed, from one ear to the other, with a row of straightened scales, or even long and large quills simulating a kind of crown"). They characterized the morphology and number of occipital and temporal "spines" ("épines") of *P. harlanii* (= *P. cornutum*), *P. coronatum*, and *P. orbiculare*, and compared the number of "thorns" between these three species

Gray (1839), in his descriptions of *Phrynosoma blainvillii* and *P. wiegmanni* (= *P. orbiculare*), made no reference to asperities of the cranial temporal or occipital regions, although his figure of *P. blainvillii* (Fig. 7) clearly shows three long temporal and two long occipital asperities, but no interoccipital. His illustration of *P. blainvillii* (1839) is much more generalized than those of *P. orbiculare* presented by Wagler (1833) and Weigmann (1834) but less stylized than that of *P. coronatum* by Blainville (1835). The occiput of *P. blainvillii* is clearly shown by Gray (1839) to overhang the dorsal and lateral aspects of the neck, with the largest cranial asperities overlapping these zones. The epidermal cladding of the horns of *P. blainvillii* is depicted to be fully or partially comprised of small, squamous, non-imbricating scales, similar to those illustrated as covering much of the dorsal and lateral regions of the head (Fig. 8), rather than being sheathed.

Holbrook (1842) stated that a distinguishing feature of *Phrynosoma* is "Head… bordered at the sides and behind with spines more or less elevated". His consideration of *P. cornuta* (= *P. cornutum*) mentions "prominent spines", distinguishing between those on the occiput and the temporal and briefly describing and enumerating those arising from each part of the cranium. The corresponding description of *P. orbiculare* likewise enumerates and characterizes the "spines" of the occiput and termporals and likens them to those of *P. cornutum*. *P. coronata* (= *P. coronatum*) is distinguished from its congeners by an "occipital region surrounded with eleven spines,… in general eleven, but I have seen thirteen, the inferior very small", and "a pointed tubercle" at the posterior terminus of the "superciliary ridge". For *P. douglassii* he states, the "superciliary ridge terminates posteriorly in a small tu-

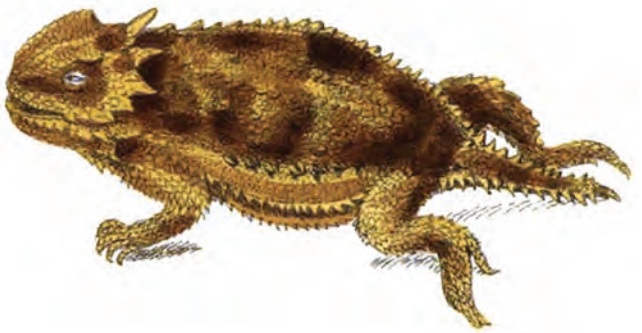

Fig. 8. *Phrynosoma blainvillii* as depicted by Gray (1839). While the horn array clearly overlies the nuchal region, the horn claddings are depicted as consisting of multiple non-overlapping scales. Not in Copyright.

bercle, very slightly pointed". This species is distinguished by "nine small tubercles, which surround the posterior and superior part of the head … disposed as in the *Phrynosoma cornuta*, yet are so slightly developed as not to deserve the name of spines, for none of them exceed two lines in length, and the central tubercle is so small as hardly to be distinguished; thus the posterior part of the head loses that spiny appearance so remarkable in the *Phrynosoma cornuta* and *Phrynosoma coronata*". Holbrook (1842) presents "in life" depictions of several species of *Phrynosoma*. Their cranial ornamentation is illustrated to show position and relative proportions, but lacks detail of their investing integument. The description of *P. douglassii* and the accompanying figure convey the impression that true horns are absent, their position being occupied instead by "tubercles".

Fitzinger.(1843) noted "*Orbitae cornutae*" ("Horned orbits") as a characteristic of *Phrynosoma*, but mentioned no additional asperities.

Gray (1845) mentioned large spines on the sides of the head, "behind", in his general description of *Phrynosoma*. He distinguished between "tubercles" and "spines" in his species accounts of *P. douglasii*, *P. orbiculare*, *P. blainvillii*, and *P. cornutum*, categorizing each as either "head tubercular" or "head spinose", and notes two "elongated spines" on the occiput of *P. orbiculare* and *P. cornutum*, while classifying asperities on the "temple" as either "tubercles" or "compressed spines".

Hallowell (1852) noted a "central spine of the crown separated from the two adjacent spines by a wide interval" as being a distinguishing feature of *Phrynosoma planiceps* (= *P. cornutum*). In his definition of the genus *Anota* (= *Phrynosoma*), Hallowell (1852) noted "a small pointed spine" at the posterior terminus of the "superciliary ridge", and further referred to the relative lengths and curvatures of the "two middle spines of the row upon the occiput", and a small "intermediate spine", in his description of *A. m'callii* (= *P. mcallii*) . Variation in "two central occipital spines" is noted for *P. orbiculare*.

Baird and Girard (1852) distinguished between the relative sizes of the "occipital and temporal spines" of *Phrynosoma platyrhinos* and *P. modestum*, without specifying any interspecific homology between them.

Girard (1852) typified the genus *Phrynosoma* by its possession of "acute spines or tuberculous knobs" and referred to a "carina" overlapping the orbit that sometimes terminates in a spine. He noted that the occipital bears the largest "spines", and that the temporal is "provided along its projecting margin with spines or conical plates, the largest of which is approximated to the occiput". He indicated differences in the orientations of the "spines" of *P. cornutum* and *P. coronatum* and referred to the temporal and occipital cephalic "spines" of *P. douglasii* and *P. platyrhinos* as "undeveloped", or, in the case of *P. douglasii*, "reduced to blunt knobs". He further characterized the cranial armature of *P. douglasii* as follows: "The occipital region…provided with three acute knobs, the central one inconspicuous. The temporal region is bordered posteriorly by three or four spines or subpyramidal plates". The occipital and temporal "spines" are distinguished from each other, and their relative intraspecific degree of expression is noted in his accounts of *P. platyrhinos* and *P. modestum*. Girard (1852) furnished highly detailed illustrations (Fig. 9) of the scutellation of *P. cornutum*, *P. coronatum*, *P. platyrhinos* and *P. douglassii*, with dorsal, lateral, ventral and frontal views of the head showing the orientation and relative proportions of the cranial ornamentation. The longitudinal fluting on the epidermal sheaths of the horns is clearly illustrated, even for the short-horned species *P. douglassii*.

Hallowell (1853) distinguished between cranial asperities of *Phrynosoma* (head "bordered at the sides and behind with spines more or less elevated") and *Anota* (superciliary ridge terminates in a "small and pointed spine"), and noted the morphology of two medial occipital "spines" and the presence of a small median "intermediate spine". *P. coronatum* (= *P. blainvillii*) was confusingly described as exhibiting an "occiput bordered with a row of nine or more spines" and an "occiput bordered posteriorly with a crown of spines, thirteen in number, extending from one angle of the jaw to the other; the two inferior on each side are very small", although it is also noted that each superciliary ridge "terminates in a pointed spine or tubercle posteriorly". The occipital "spines" of this species are compared to those of *P. cornutum*. Hallowell (1853) accepted Hallowell's (1852) *P. planiceps* (= *P. cornutum*) as a valid taxon, noting that its median occipital "spine" was separated from the two lateral to it by a wide diastema, evidently tacitly accepting the interspecific homology of these structures. Again he states there are nine "spines upon the posterior part of the head", with the median being small. He compared the sizes of the three "lateral spines" to those of *P. cornutum*, thereby implicitly imputing interspecific homology, based upon position, to these asperities. Hallowell (1853), given the course of the reported expedition, seemingly erroneously recorded seven specimens of *P. orbiculare*; these are more likely *P. hernandesi* or *P. ornatissimum*. The

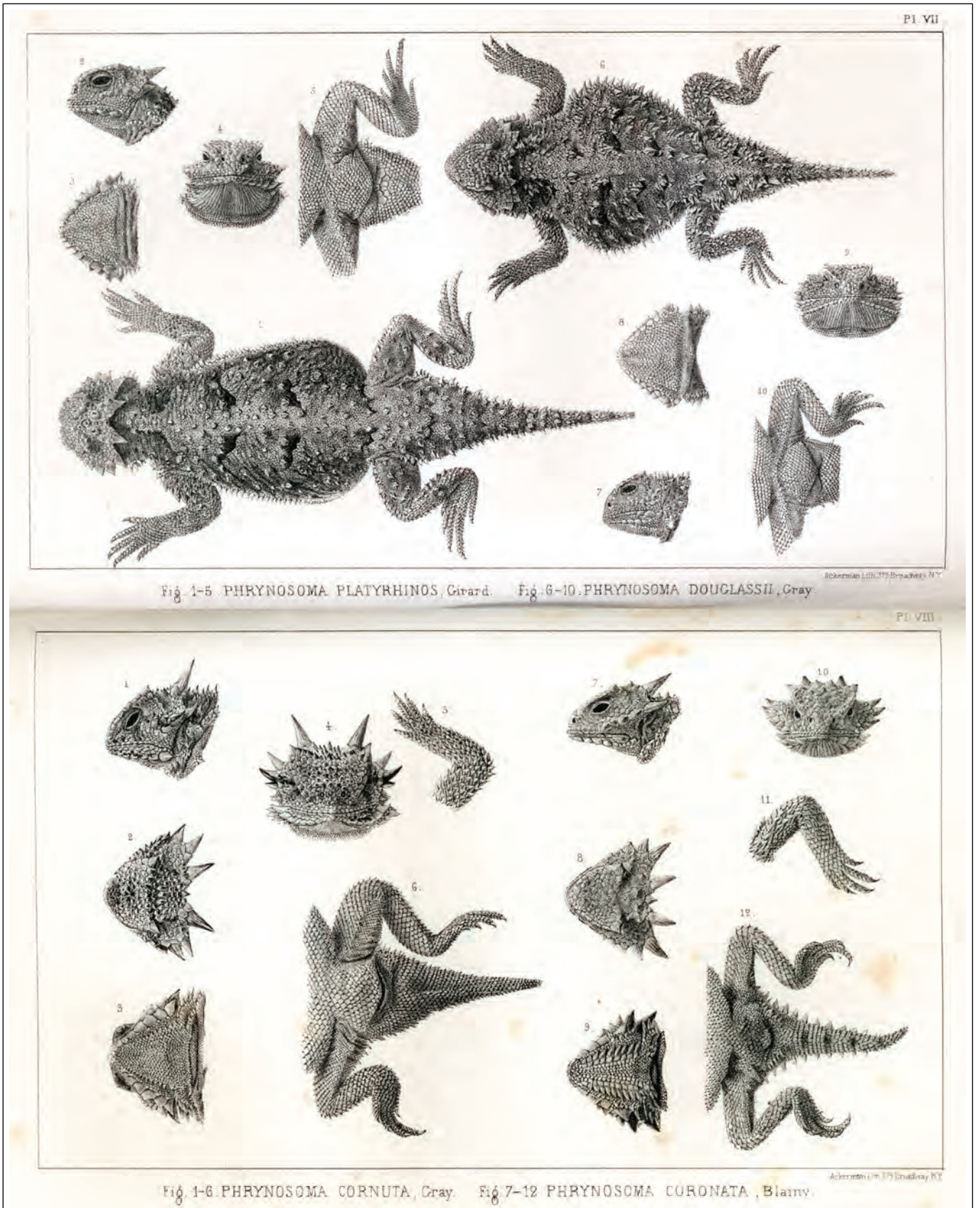
Pl. VII
Fig. 1-5. PHRYNOSOMA PLATYRHINOS, Girard.
Fig. 6-10. PHRYNOSOMA DOUGLASSII, Gray.
Pl. VIII
Fig. 1-6. PHRYNOSOMA CORNUTA, Gray.
Fig. 7-12. PHRYNOSOMA CORONATA, Blainv.

Fig. 9. Illustrations of *Phrynosoma platyrhinos* (top left), *P. douglasii* (= *P. hernandesi*) (top right), *P. cornuta* (= *P. cornutum*) (bottom left) and *P. coronata* (= *P. blainvillii*) (bottom right) from Girard (1852). Public Domain.

illustrations of *P. cornutum*, *P. orbiculare* and *P. mccallii* lack the details of scalation evident in the figures of phrynosomes rendered by Girard (1852).

Girard (1858) included cranial asperities in his characterization of *Phrynosoma* ("temporal and occipital regions spinose"; "provided with acute spines or tuberculous knobs") and distinguished between "spines" arising from the occipital (generally the largest) and "spines or conical plates" upon the projecting margin of the temporal. Among the characteristics of the subgenus *Tapaya*, he stated: "… spines short and subconical, sometimes very much attenuated". Species differences in "spine" development were noted within *Tapaya*; evidently the "temporal" and "occipital" "spines" were tacitly assumed to be homologous among species. Of the subgenus *Batrachosoma*, he stated, "Spines large". For *B. coronatum* (= *P. blainvillii*), he listed, and characterized the orientations of, "two occipital and five temporal spines", the anteriormost of the temporal "spines" being noted to be "rudiments". "Spines very large" is part of Girard's (1858) description of the subgenus *Phrynosoma.* For *P. cornutum* he states, "temporal and occipital spines, subconical, long and acute; occipital ones much the largest and raised above the others". The "temporal and occipital spines" of *P. regale* (= *P. solare*) are described as "flat and acute, constituting a continuous series, very much inclined backwards"; this is identified as "a most characteristic species, not only by the disposition of the temporal and occipital spines on the same plane, but likewise by these spines being set closely together, so as to leave no interval between them at their base". This he likens to the arrangement of the "cephalic spines" exhibited by *P. mcallii*, but he distinguishes *P. solare* as the only species exhibiting "four subequal occipital spines". Thus, horn number and morphology are considered to be characters of taxonomic significance for the latter species. For the subgenus *Doliosaurus*, the "spines" are "but moderately developed; occipitals higher than the temporal ones". For *D. mc'calli* (= *P. mcallii*), it is stated "occipital spines rather elongate and slender", with the "spine" arrangement and morphology being described in some detail. *D. platyrhinos* (= *P. platyrhinos*) is described as having "occipital spines of moderate development, while *D. modestus* (= *P. modestum*) bears "cephalic spines" resembling those of *P. platyrhinos*, although "less developed".

The foregoing indicates that Girard (1858) employed external anatomy and, to a lesser degree, number, of horns in his accounts of the various species of *Phrynosoma*, noting diagnostic differences of the horns between species, thereby tacitly assigning them the status of interspecific homologues.

The illustrations of phrynosomes presented by Baird (1858), in a volume accompanying Girard (1858), like those of Girard (1852), lack details of head and body scalation, although they do show the longitudinal fluting on the epidermal sheaths of some of the horns of some species (Figs. 10a and 10b).

Cope (1864) described *Phrynosoma asio* as bearing "horns"; two diverging lateral ones emerging from the "temporo-occipital crest", two vertical occipitals, and a "high acute posterior superciliary". Subsequently Cope (1866) noted the "temporal spines" of *Tapaja ornatissimum* (= *Phrynosoma hernandesi*).

Duméril and Bocourt (1874) published what was then the most comprehensive review of the systematics of *Phrynosoma*. They erected the subfamily *Phrynosomiens*, characterized by, among other features, *"Tête court…bordée postérieurement et latéralement de forts piquants, plus ou moins longs et de nombres variable.*" ("Short head… bordered posteriorly and laterally by strong prickles , somewhat elongated and of variable number.") and noted that "*Ainsi un Phrynosome, à quelque espèce qu'il appartienne, offre un grande ressemblance avec toute autre de ses congénères; mais, si l'on compare l'armure èpineuse de la tête, sans même tenir compte de la forme de celle-ci, qui n'est pas toujours identique, ... on constate des nombreuses et trés manifestes différences*." ("Thus a phrynosome, whatever species it belongs to, shows a great resemblance to any other of its congeners; but, if we compare the spinous armor of the head, without even taking into account its shape, which is not always identical, …there are many and very obvious differences"). Despite this, cranial asperities were not among the tabulated characters of their subgenera (Duméril and Bocourt 1874: p. 220), although they were included in the text in the general diagnosis of each subgenus, e.g., "*Sous-Genre Tapaya: Tètes à épines céphaliques fort courte ou de médiocre longeur, au nombre de dix: duex sus-orbitaires, six temporales et deux occipitales.*" ("Subgenus Tapaya: Head with cephalic spines very short or of modest length, ten in number: two supraorbital, six temporal and two occipital"). Relative sizes and orientations of "*épines*" were characterized and contrasted within and between species of *Tapaya* (Duméril and Bocourt 1874). For their subgenus *Phrynosoma*, they noted "*Épines céphalique ordinairement bien développées et en nombre variable selon les èspeces*." ("Cephalic spines usually well developed and variable in number depending upon species."). *P. platyrhinos*, *P. modestum*, and *P. planiceps* (= *P. cornutum*) were distinguished from one another by the relative lengths of their occipital "*épines cephalique*" ("cephalic spines"), and *P. regale* (= *P. solare*) was distinguished from the remaining species of the genus by "…*quatre épines occipitales plus prolongées en arrière que la plus longue des temporales, formant avec ses dernières et les scutelles inframaxillaires uns série circulaire se terminant au menton*" ("four occipital spines extending further backwards than the longest of the temporals, forming with its last and the inframaxillary scutes a circular series ending at the chin"). Morphology and number of temporal and occipital asperities were noted by Duméril and Bocourt (1874) for the remaining species of their subgenus *Phrynosoma*, particularly *P. taurus* ("*Tête terminée de chaque côté par une épine terminal très prolongée en arrière; occiput armé de deux autres épines fort petites et tuberculeuses*." [Head ends on each side in a very extended terminal posterior spine; occiput armed with two more very small and tuberculous spines.]). They characterized their

subgenus *Batrachosoma* as follows *"...à épines céphalique assez longues, bien séparées les unes des autres et en nombre variable.*" ("… with fairly long cephalic spines, well separated from each other and of variable number.") and distinguished between its species (*P. coronatum* and *P. asio*) by the number, development and orientation of these "spines". Through all of this it is evident that the cephalic asperities referred to as "*épines*" by Duméril and Bocourt (1874) are tacitly considered to be, collectively, similar structures. They note that the "temporals" can vary in number from species to species without being considered, collectively, to be different. The occipital "*épines*" were noted to be generally constant in number from species to species, and thus might be considered to be the same structures. The sole exception, *P. solare*, was noted to have four occipital asperities, but nothing further was made of this. Illustrations furnished by Duméril and Bocourt (1874) are schematic (Fig. 11), showing, in most instances, only localized regions of scalation interspersed by areas devoid of any surface details. The figures are skillfully presented with regard to proportionality and contrast, thereby showing regions of overlap of the neck by cranial horns. Longitudinal fluting on the epidermal sheath of some horns is evident, but lacking for others. Although horn number and morphology are employed by Duméril and Bocourt (1874), no structures are labelled or identified in the accompanying schematic illustrations of the head of any species (Fig. 11), rendering the identification and enumeration of pertinent features for comparative purposes difficult.

Peters (1874), in describing *Phrynosoma spinimentum* (= *P. asio*) noted "*... die Form der grossen Stacheln des Kopfes…"* ("…the shape of the large spines of the head…") differ from those of *P. coronatum*, and further stated that "*Die beiden mittleren Hinterhauptsstacheln durch funf flache Schuppen von einender getrennt*" ("The two central occipital spines [are] separated from one another by five flat scales). Again, the occipital "spines" (*Hinterhauptsstacheln*) are intimated to be of some systematic importance but are not compared to those of other species.

Yarrow (1875) contended that *Phrynosoma cornutum* had more slender occipital and temporal "spines" than *P. coronatum*, depicting the head of the former accurately but in no more detail than earlier illustrations. Subsequently Yarrow (1882), in his description of *P. douglassi pygmaea* (= *P. douglasii*), characterized it, among other features, by the length and shape of its "occipital and temporal spines".

The rather generalized illustration by Brehm (1878), apparently of *Phrynosoma cornutum*, adds no visual clarification to earlier accounts, and his description of *P. orbiculare* notes "*Acht Stacheln von ziemlicher Länge waffen den Hinterkopf*..." ("Eight thorns [horns] of sizeable length arm the posterior portion of the head..."). He does distinguish these asperities from the "*Hornspitzen*" ("spines") fringing the trunk.

One feature Boulenger (1885) ascribed to species of *Phrynosoma* was "Head… bordered posteriorly by osseous spines". He distinguished among species by the number, relative length, and orientation of temporal and occipital "spines". He referred to the cranial bone of origin when describing "spines" and appears to restrict this usage to "spines" arising from the squamosal when referring to "temporal spines".

Gentry (1885), in his characterization of *Phrynosoma,* noted that the head bears strong "spines" that vary in length and number. His synopsis of the characters of the genus incorporated the relative length and orientation of the temporal and occipital "spines", and noted whether scales intervene between "spines" at their bases. He did not distinguish between squamosal and jugal temporal "spines".

Stejneger (1890) referred to the relative size and orientation of "occipital spines" and "temporal spines" among features distinguishing *Phrynosoma hernandesi* from *P. ornatissimum* (recognizing these as different species). Later Stejneger (1893) described *Phrynosoma cerroense* as a new species and noted "medium [sic] occipital spine reduced to a tubercle", indicating that he considered this asperity to be homologous among species. He also examined the length, shape and orientation of "head spines" in *P. platyrhinos* when attempting to distinguish subspecies. He used the descriptors "occipital spines" and "occipital horns" interchangeably. In his description of the new species *P. goodei* he noted "three temporal horns only on each side, the posterior one nearly in a line with and of the same size as the occipital horns", thereby distinguishing "temporal" asperities from those carried on the "occipital" and referring to them as "horns". He provided schematic figures of dorsal and lateral views of the head of *P. hernandesi* and *P. ornatissimum*, upon which the longitudinal fluting of the epidermal horn sheaths is depicted, even for these short-horned taxa.

In his description of *Phrynosoma frontalis* (=*P. blainvillii*) van Denburgh (1894) noted "Head spines, one occipital, three large posterior and two smaller anterior temporals, and one postorbital, on each side; and one small interoccipital", thus apparently grouping, under temporals, asperities arising from both the jugal and the squamosal.

Cope (1896) described *Anota calidiarum* (= *Phrynosoma platyrhinos*) as bearing moderate "occipital horns" and noted the presence of an "accessory horn" at the base of each. Three temporal "horns" are recognized, with the first being highly reduced. He thus limited the appellation "temporal horns" to those arising from the squamosal in this species.

In his key to the genera of the Iguanidae, Cope (1898) included "bony spines" on the posterior borders of the cranium as a character of both *Phrynosoma* and *Anota* (= *Phrynosoma*). He subsequently variously characterized, for *Phrynosoma*, these structures as "osseous spines", "horny processes of the skull", and simply "horns". His descriptions of the cranial osteology of *P. douglassi*, *P. cornutum*, and *P. coronatum* indicate that the "parietoquadrate arch [= parietal] supports a horn or tuberosity" in all three species; the jugal supports two "sharp tuberosities" in *P. coronatum*, as does the supratemporal; the latter gives rise to three in *P. cornutum* and *P.*

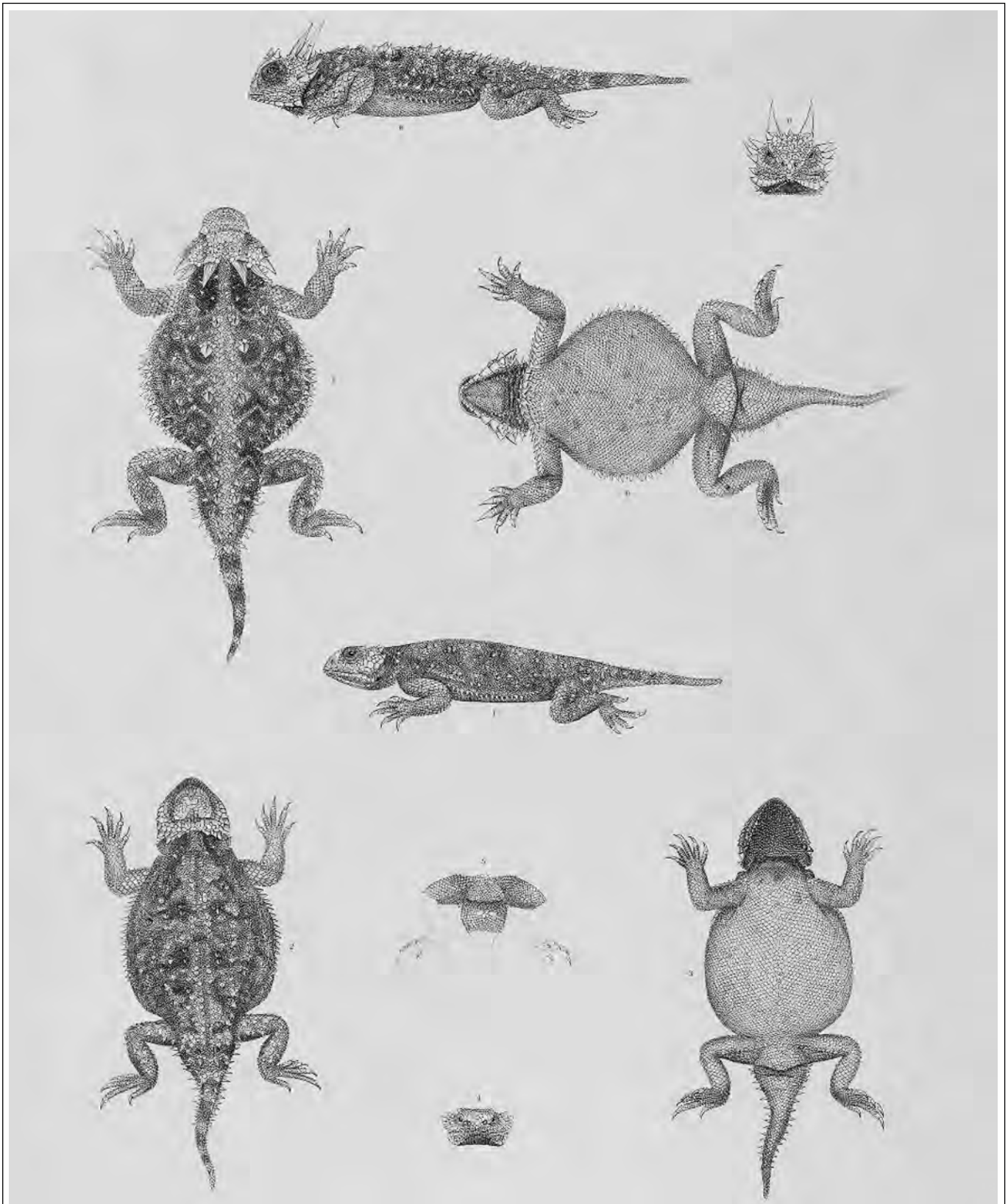

Fig. 10a. Illustrations of *Phrynosoma cornutum* (top), and *P. hernandesi* from Baird (1858). Public Domain.

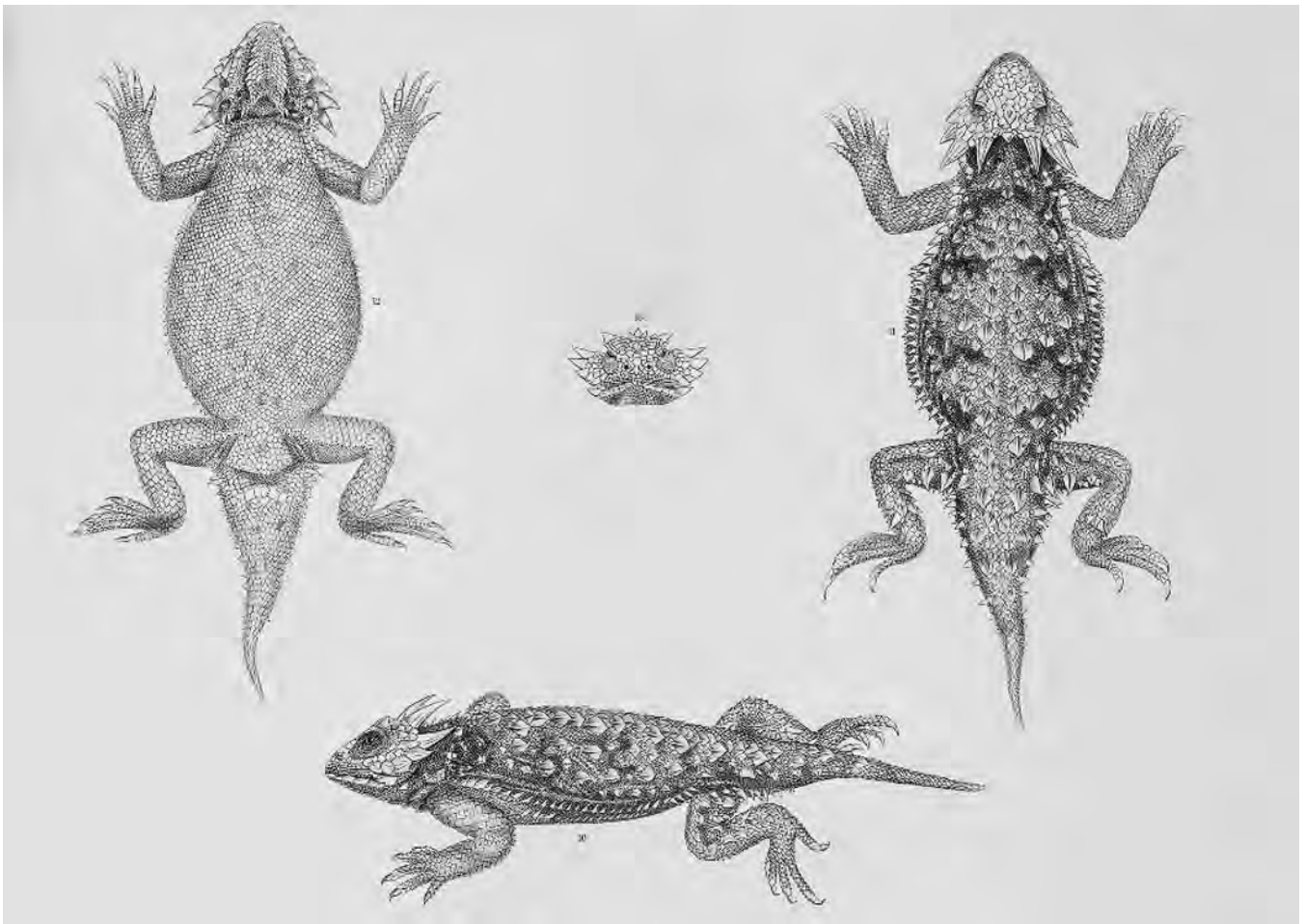

Fig. 10b. Illustrations of *Phrynosoma blainvilii* from Baird (1858). Public Domain.

douglasii. His species key (based upon external anatomy) features relative "horn" length and orientation in addition to occipital "horn" number and asperities characterized as "temporal cones" or "conic plates". *P. solare,* in particular, was characterized by the possession of four occipital "horns", indicating that the "horns" of the parietal were considered to be different from those elsewhere on the cranium. Cope (1898) tacitly assigned asperities on specific bones some identity and thus homology. In his description of *Phrynosoma asio* he inferred reduction of the number of "temporal horns" to two, suggesting that he regarded three as the ancestral condition. *P. taurus* is described as bearing one "temporal spine"; the remainder of the temporal series and the occipital asperities were characterized as "rudiments"; this suggests that he regarded these small asperities as representing an ancestral condition, and his assumption of an ancestral number of asperities implies homology. Of *P. douglasii*, Cope (1898) noted "horns represented by conical protuberances", giving numbers and relative sizes and distinguishing subspecies in part by the relative size of "head spines". He distinguished among the species of the *coronatum* species group using horn magnitude and orientation; the anteriormost "temporal" asperity was characterized as a "scale" in *P. blainvillei* (= *P. blainvillii*) but "four horns of the temporal series" were noted for *P. coronatum*; the homology of the anteriormost "temporal" asperity appears to be assumed. Cope (1898) noted the presence of "four produced [sic] tubercles" on the temporal of *P. cerroense*, but then characterized the morphology of a fourth temporal "horn" and occipital "horn", again indicating the assumption of interspecific homology.

Cope (1898) includes many illustrations of dorsal and lateral views of phrynosome heads, depicting scalation (in a schematic manner). Longitudinal fluting of the epidermal sheaths of the horns of only some species is indicated (Fig. 12). For comparative purposes this series of figures permits visualization of the relative dimensions and orientation of cranial asperities within the genus, but does not readily enable differentiation of horns from other cranial protuberances (Fig. 12). Despite verbal descriptions of cranial osteology of phrynosomes there are no accompanying figures of the skull, rendering the connection between external morphology and skeletal underpinnings somewhat opaque.

Cope's (1898) key to the species of *Anota* (= *Phrynosoma*), features "horns" as characters. *A. modesta* (= *P. modestum*) was stated to bear a temporal series of "acuminate tubercles", only the last being "distinctly a horn", but no interoc-

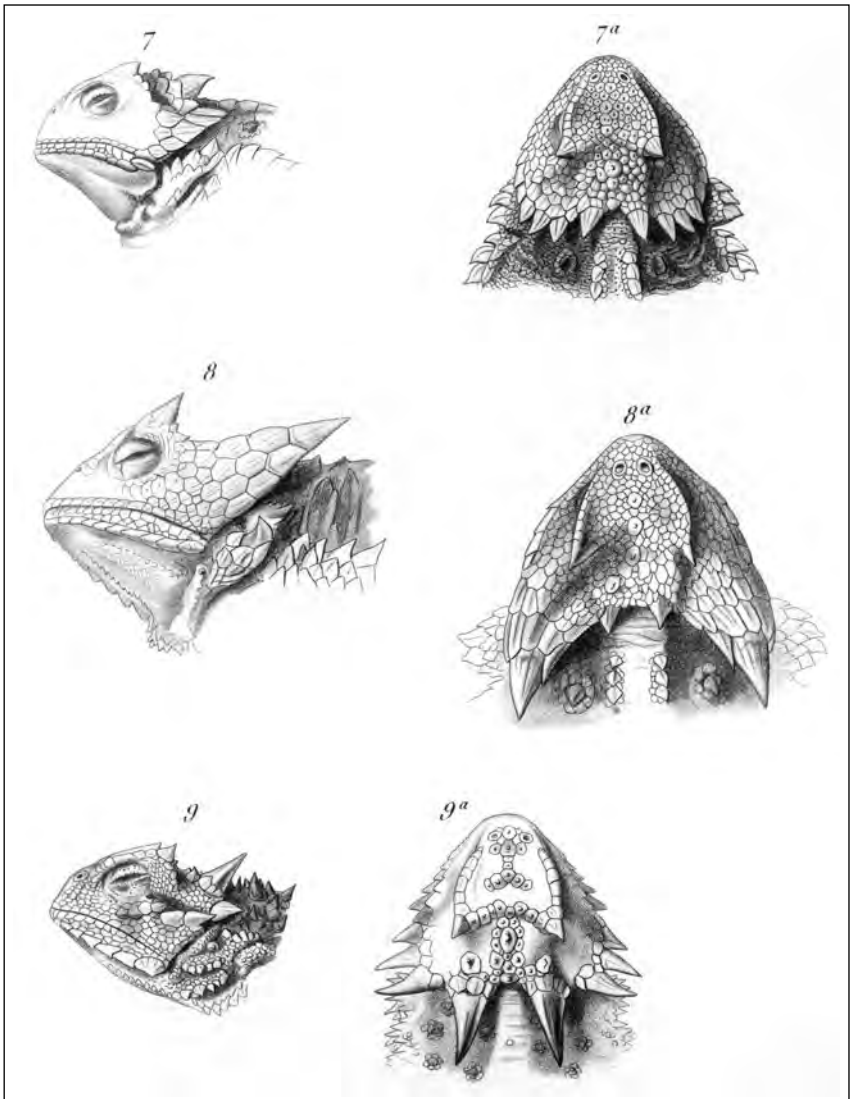

Fig. 11. Dorsal and lateral views of the heads of *Phrynosoma braconnieri*, *P. taurus* and *P. cornutum*, from Duméril and Bocourt (1874). Not in Copyright.

cipital. *A. calidiarum* (= *P. platyrhinos*) was noted to display only two "temporals", asperities anterior to these "presenting a serrate edge only". *A. goodei* (= *P. goodei*) was described as bearing "Three temporal plates especially prominent, the last of which developed into a horn". Despite Cope's (1898) inconsistent terminology for cranial asperities, he implicitly assigns interspecific homology to "horns" in the species he documented.

Twentieth Century

In his description of *Phrynosoma ditmarsi*, Stejneger (1906) stated it to be "practically without its horns", suggesting that he regarded this as a secondary loss. Confusingly, his diagnosis included "no horns" as a character, which he expanded upon, stating "the scales of which form in the other species more or less projecting spines being only low bosses or protuberances". He homologized, by position, the cranial asperities of *P. ditmarsi* with "horns" of other species — "scale corresponding to outer temporal horn in other species, two scales corresponding to temporal horns slightly enlarged, depressed, the posterior, or inner, slightly pointed…" — and stated that "scutes" in corresponding locations on the head of *P. ditmarsi* do not appear to be "retrograded horns as in some forms of *Phrynosoma douglassii*", although their actual nature is unstated.

Ruthven (1907) characterized the cranial armature of *Phrynosoma hernandesi* as "Horns reduced, consisting of three temporals and one occipital…", thereby implying longer "horns" to be the ancestral state, and thus that horns are homologous between ancestral and descendant species. He also referred to the "superciliary horns" of *P. cornutum* and described *P. solare* as bearing "four occipitals and six temporals".

Bryant (1911) documented species of *Phrynosoma* as bearing a "circlet of horns", but opined that these proffer no dependable classificatory characters. His diagnosis of *Phrynosoma* mentions "grooved spines" on the head, varying in number and length, and noted "bony spines", varying in length and number on the temporal and occipital regions. In his account of general cranial osteology of *Phrynosoma*, he noted that the parietal, squamosal, and sometimes the jugal, bear "spines", but subsequently characterized the parietal as supporting "several horns", usually two with a "rudimentary" horn between, and four well-developed in *P. solare*. He also noted "spiny tuberosities" on the supratemporals and jugals, except for *P. douglassi* and *P. cornutum*, in which there may be "tubercles" on the jugal. Confusingly, Bryant (1911) consistently identified the rictal asperity as a "spine" despite it being a solely integumentary structure.

Bryant (1911) characterized the cranial anatomy of several *Phrynosoma* species. For *P. douglassi douglassi* (= *P. douglasii*), he noted the lengths and orientations of occipital and supratemporal "horns", describing these as "very rudimentary" ("reduced to blunt, conical tubercles") and stating that the interoccipital's place is marked by an "enlarged scale". Occipital and squamosal "horns" of this species were recognized and three squamosal "horns" clearly illustrated (Bryant 1911: Fig. C). He described *Phrynosoma blainvilli blainvilli* (= *P. blainvillii*), externally, as bearing three to six "supratemporal horns" per side. Osteologically, this species was noted to bear two "horns" on the squamosal (shown in Bryant 1911: Fig. D), and three to four "tuberosities" on the jugal. *P. blainvillii* was distinguished from *P. coronatum* by "horn" development and, apparently, supratemporal (= squamosal)

"horn" number (Bryant 1911). Externally, *P. platyrhinos* was characterized as bearing five to seven temporal "horns", the posterior three being the best-developed, whereas those more anterior are "mere tubercles". Three squamosal "horns" were characterized and illustrated by Bryant (1911: Fig.E); there is no interoccipital asperity illustrated here, although an "interoccipital horn" is characterized by him as a "small tuberosity". Species of *Anota* (= *Phrynosoma*) were characterized as bearing "long, smooth spines". Externally, he ascribed five to six temporal "horns" to *A. maccalli* (= *P. mcallii*) and in his account of its cranial osteology he noted a small "tuberosity' at the base of each occipital "horn". There is no mention of an interoccipital "horn", but one is shown and labelled as such in his Fig. F. Interestingly, Bryant (1911) noted that in some species of *Phrynosoma* cranial scales are supported by bony outgrowths, and that these are not secondary ossifications of the scales subsequently fused to the bone. He hypothesized that the ancestral condition of "horns" in *Phrynosoma* was outgrowths of cranial bone supporting prominent scales.

Boulenger (1916), in describing a supposed new species, *Phrynosoma brevicornis* (= *P. cornutum*), noted the number (one supraorbital, three temporals, one occipital) and sizes (very small) of the cranial "spines".

Barbour (1921) described the "postorbital", temporal and occipital "spines" and the squamation associated with them in his description of *Phrynosoma schmidti* (= *P. cerroense*).

Schmidt (1922) described two apparently new species of *Phrynosoma* from Baja California. For *P. nelsoni* (= *P. cerroense*) he noted temporal and occipital "horn" number and morphology, and the presence of a medial occipital "spine". Positions and relative sizes of the "horns" were provided (e.g. "last temporal"). For *P. jamesi* (= *P. cerroense*), the positions and relative sizes of four temporal "spines" were noted, and "spines" were employed as characters in the accompanying key.

van Denburgh (1922) included "bony spines on the occipital and temporal regions" as characters of *Phrynosoma*, but used both "spines" and "horns" to refer to the same structures in the key. Numbers and locations of "head spines" were frequently noted in his species accounts, based on external anatomy; nonetheless, occipitals and "temporals" are considered separately. *P. ditmarsi* is described as being "without horns", but "scales" corresponding to "horns" were referred to, suggesting that they are implicitly considered to be homologous with "horns", in this species at least.

Smith (1942) referred to both "spines" and "horns" in his description of *Phrynosoma douglassii brachycercum*, and noted numbers and relative development of these asperities on different parts of the cranium (occipitals and "temporals").

Smith (1946) referred to both "horns" and "spines" in his key to the species of *Phrynosoma* of the United States and Canada, restricting the employment of "spines" to what currently are recognized as the species of the *douglasii* complex. Oddly, he denoted the cranial asperities of *P. ditmarsi* (which he called the "Hornless Horned lizard") as "horns" in the key but characterized the head initially as being "hornless" and then as bearing "low protuberances" in the place of "scales which form spines in other species". Other species accounts refer to both "spines" and "horns" interchangeably. Smith (1946) distinguished between occipital and "temporal" asperities and noted interspecific differences in the numbers of each.

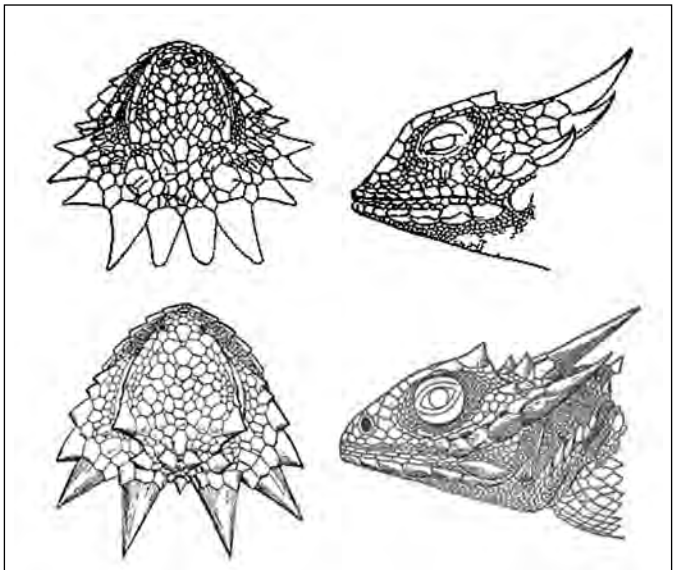

Fig. 12. Dorsal (left) and lateral (right) views of the heads of *Phrynosoma solare* (top) and *P. blainvillii*, from Cope (1898). Not in Copyright.

Broom (1948) described the cranial osteology of a specimen he attributed to *Phrynosoma cornutum*. The morphology depicted in his figures, however, indicate that it is a member of the *coronatum* species group. He used the term "horns" for the two large and one median small parietal asperities, noted one small and two "rudimentary horns" on the jugal, one small "horn" on the frontal, and two "well-developed" horns on each of the squamosals.

Detrie (1950), describing the features of *Phrynosoma cornutum*, used the term "spines" for both the epidermal structures of the body and the osseous asperities of the cranium, and further called cranial asperities both "spines" and "horns". In describing the cranial osteology of this species he identified "three prominent horns called the temporal horns" arising from the squamosal, but made no reference to horns arising from the parietal. He does, however, mention "paired occipital horns" in his description of the external anatomy of the head.

Reeve (1952), in his general description of the cranial osteology of *Phrynosoma*, listed two lateral "spines" and one medial "spine" on the parietal, and three "moderately large spines" on the squamosal. He documented the number and morphology of "occipital spines" and "temporal spines" (the latter apparently incorporating both jugal and squamosal asperities) in his evaluation of taxonomic characters of the genus (under the heading "Squamation"). The "superciliary spine" was rejected as a useful taxonomic character because

of its variability. Numbers and morphology of "occipital spines" and "temporal spines" were included in his key to the species and subspecies of *Phrynosoma*. For *P. ditmarsi*, he first stated "characteristic 'horns' absent", then noted the absence of the "spines". The "superciliary spine" was referred to in *P. asio*. He referred to lateral "soft spines" on the body, implicitly distinguishing these from the osseous asperities of the cranium. He also identified the postrictal "spine", a solely integumentary structure. In his species and subspecies accounts he generally referred to cranial "spines", but occasionally used the term "horn", apparently for the same asperities, and noted that in some species the "spines" are reduced to "tubercles", implying homology. Reeve reconstructed the common ancestor of *Phrynosoma* as bearing "medium to small-sized head spines… two major occipital and five temporal spines".

Davis (1953) proposed a new subspecies of *Phrynosoma orbiculare*, *P. o. alticola*, describing in some detail the number and morphology of the occipital and temporal "spines".

Horowitz (1955) used the ratio of the length of the "occipital horn" to body length as a character in his revision of the subspecies of *Phrynosoma orbiculare*. He noted the separation of the occipital "horns" from the "temporal series" and characterized the morphologies of both types of "horns". Differences in "horn" length were included in his diagnosis of subspecies.

Brattstrom (1955) assigned a Pleistocene fossil squamosal from Mexico to *Phrynosoma orbiculare* on the basis of "temporal spine" number and morphology. He described a new species from the same locality (*P. josecitensis*), based upon number (four) and morphology of "spines" on a fragmentary squamosal. He compared the morphology and location of these "spines" to those of extant species, thus implicitly accepting homology between them.

Etheridge (1964) referred to "bony tuberosities, spines, or horns" on the "dentary, prearticular, supra-angular, parietal, frontal, postorbital, jugal, and squamosal" of *Phrynosoma*.

Jenkins and Tanner (1968), in describing the cranial osteology of *Phrynosoma douglasii* (= *P. hernandesi*) and *P. platyrhinos*, referred to a "postorbital spine", "occipital spines" (stated to be labelled as such for consistency with the previous literature) and "temporal spines" which they located on the lateral border of the squamosal. An "interoccipital spine" was also noted, although characterized as a "tubercle". They suggested that the relationship between length of the "occipital spines" and the depth and length of the lower jaw may be of some taxonomic significance.

Holman (1969), discussing the herpetofaunal component of an Illinoian fossil assemblage from north-central Texas, attributed a squamosal with "all three of its spines" to *Phrynosoma cornutum*, based upon the relative and absolute sizes of these "spines" and the morphology of the squamosal itself. He compared these to those of other extant species of *Phrynosoma*, evidently considering squamosal "spines" in corresponding positions to be homologous among species.

Presch (1969) referred to "bony processes of the parietal, squamosals and dentary" in his general description of *Phrynosoma*, and referred to "spines, tubercles and rugosities" adorning the "skull roof" as one of the features distinguishing it from the remainder of the sceloporines. A "pair of horns" was identified as arising from the posterolateral corners of the frontal. Numbers of "bony processes" arising from the jugal in the different species of *Phrynosoma*, and their associations with "bony processes" arising from the postorbital and squamosal, when present, were documented. Morphological variation among species in the "lateral horns" arising from the parietal were noted, as was the presence or absence of a "median parietal horn". The numbers and morphology of the "horns" on the squamosal among species were detailed. He regarded a squamosal bearing "two horns", and a parietal bearing none, as the ancestral state for *Phrynosoma*; the derived condition for the parietal being given as "with spines and horns", and for the squamosal as "with four horns". This implies homology among species.

Holman (1972) referred to "a complete right and two fragmentary principal horns" from the lower Pleistocene of north-central Nebraska and attributed this specimen, on the basis of its "horn" morphology, to *Phrynosoma cornutum*. Implicit is the assumption that these "horns" have identity and are phylogenetically conserved.

Parker (1974), in his entry for *P. solare*, characterized four (sometimes two) equal-sized occipital "spines", with their bases close together, continuous with large temporal "spines".

Montanucci (1979), in his revision of the subspecies of *Phrynosoma orbiculare*, referred to the relative sizes and orientations of the "occipital horns" and "superciliary spines", among other characters.

For *Phrynosoma mcallii* Funk (1981) characterized the morphology and number of the occipital and temporal "spines".

Montanucci (1987), in his phylogeny of *Phrynosoma,* referred to "enlarged horns" on the head as a distinguishing feature of the genus. He specified that "enlarged horns" are borne by the parietal and the squamosal, and that "small tubercles or horns have appeared" on other elements of the cranium and lower jaw. He also mentioned a "superciliary spine" on the frontal. He noted "two horns" on the parietal (four in *P. solare*, designated as a derived character state, the second parietal horn possibly being derived from a bony tubercle lateral to the base of the parietal "horn" in other species), and listed variations within and among species in parietal "horn" length, dividing species into categories based upon this. The squamosal was noted to bear multiple horns, and to vary among species. He hypothesized that the ancestral condition for *Phrynosoma* was two squamosal "horns", and that the "single, greatly enlarged horn" of *P. taurus* was derived from a "three-horned squamosal". Among the morphological characters employed in deriving his phylogeny, only one involved "horns" (presence/absence of large scale at base of

"parietal horn", or "second parietal horn present"), this being recovered as a synapomorphy of the clade (*P. solare* (*P. mcallii* (*P. modestum, P. platyrhinos*))). In his discussion of evolutionary trends in the genus, he considered changes in sizes of parietal and squamosal "horns", and the acquisition of additional "horns" on these elements, evidently considering them to be homologous in aggregate. In his assessment of a Pleistocene fossil, *P. josecitensis*, he considered squamosal "horn" morphology and number.

In his account of *P. cerroense,* Jennings (1988a) differentiated between occipital "spines" and temporal "spines", enumerating each. For *Phrynosoma coronatum*, Jennings (1988b) again noted these features and cited the number and orientation of temporal "spines" in subspecific diagnoses.

Etheridge and de Quieroz (1988), in their phylogeny of the Iguanidae, listed "Horns or tuberosities acquired on parietal, squamosals, and sometimes other skull elements" as one of the synapomorphies of *Phrynosoma*. They did not list numbers of such asperities for each bone, considering their aggregated presence to be a character in itself.

Norell (1989) described *Phrynosoma anzaense*, an extinct Pliocene species represented by a partial skull. He described a large "horn" on the posterolateral border of the frontal, two "horns" on the fragmentary jugal and three "horns" of differing sizes and orientations on the squamosal. Two "horns", and their morphologies, were characterized as arising from the posterior border of the parietal, with a "small spine on [sic] a tubercle" located between the "horns". In evaluating the distribution and morphology of osteological cranial asperities of *Phrynosoma*, he noted great phylogenetic variation in the "pattern of squamosal horns" among extant species, describing numbers and shapes and also noting the presence and positions of "accessory horns" on this element. He stated that the modal number of "horns" arising from the posterior border of the parietal is two but that some species (*P. solare*, *P. modestum*, and "large" *P. douglasii*) four are present; only in *P. solare* is the "additional pair of horns significantly developed". A "small median horn", originating on a "bony "osteoderm"" arising from the rear border of the parietal between the "large horns", was noted for some species.

Pianka (1991) considered the relative length of "occipital horns" and "temporal horns" in *Phrynosoma platyrhinos*. Differences in the number of "temporal horns" and the morphology of "occipital horns" were noted among its subspecies.

Price (1991) characterized the number and morphology of "temporal spines" and "occipital spines" in *Phrynosoma cornutum*, and considered the single pair of "occipital spines" (in combination with other characters) to be diagnostic for the species.

Hodges (1995) characterized the occipital and temporal "horns" of *Phrynosoma ditmarsi* as being "reduced to rounded, flaring expansions on either side of the head", and stated this to be one of the distinguishing features of the species. This implies an assumption of homology of these asperities with those that are more developed in other species.

Whiting and Dixon (1996), in their account of *Phrynosoma modestum*, noted two temporal and two occipital "spines" of approximately equal size, but puzzlingly then stated the presence of four occipital "spines" of approximately equal moderate size to be a diagnostic feature of this species, further likening this condition to the to four occipital "spines" of *P. douglasii*. This implies the assumption of interspecific homology for these asperities.

Brattstrom (1997) observed that previous authors had used the number and orientations of "temporal spines" to distinguish between subspecies of *P. coronatum* (= *P. coronaturm*, *P. cerroense*, *P. blainvillii*), but contended that "spine" orientation is too variable for this purpose.

Mead et al. (1999), in attempting to assign fragmentary fossil *Phrynosoma* parietals and squamosals to species, noted the presence of both "horns" and "tubercles" on their specimens. They concluded that these asperities permitted assignment to *P. orbiculare* based upon morphological comparison and an implicit assignment of homology to individual "horns" by position on the squamosal.

Twenty-First Century

Powell et al. (2002) devised a nomenclatural convention for the "horns" of *Phrynosoma orbiculare* based upon element of origin and position on that element. By implicitly assigning homology to individual 'horns" among species, this nomenclature was intended for general use for the genus as a whole.

Montanucci (2004), in his revision of the *Phrynosoma coronatum* species complex, did not distinguish between the postrictal "spine" (a purely integumentary structure) and the interoccipital "spine" (an osseous asperity). He used temporal "horns" and the length of the "occipital horn" as characters in his analysis. He noted a "reduced horn or scale" between the "third temporal horn" and the "fifth temporal horn", implying that he regarded the former as having identity because its magnitude was observed to vary between taxa. In his description of *P. wigginsi* (= *P. cerroense*), he compared the morphology of the temporal "horns" to those of *P. blainvillii*.

Mulcahy et al. (2006), in their examination of the phylogeography of *Phrynosoma mcallii* and its relationship to southern populations of *P. platyrhinos*, used horn morphology and number, among other morphological characters, in their initial evaluations of putative interspecific hybrids (preliminary to genetic analysis). They describe *P. mcallii* as bearing "two large occipital horns directed posteriorly, and two enlarged laterally protruding temporal horns", and *P. platyrhinos* as exhibiting "a moderate crown of horns, with the occipital row directed posteriorly, and three enlarged posterior-laterally protruding temporal horns". Homology at least at the level of general horn origin (temporal or occipital) appears to be assumed, particularly in the descriptions of the horns of putative hybrids. *P. goodei* is recovered as a valid species on the basis of this genetic analysis, and *P. platyrhinos* redefined, and for both species, these authors describe

horn morphology, implicitly assigning homology to the "occipital horns", at least.

Leaché and McGuire (2006) referred to cranial "horns" in their revision of *Phrynosoma*. Their reconstruction of ancestral "horn" length was based upon the longest "horn" on the right side of the head, regardless of bone of origin or position on that bone.

Bergmann et al. (2009) included "horn" length in their phylogenetic analysis of body dimensions and sprint speed in phrynosomatine lizards. Length of the longest "horn", regardless of its element of origin, was recorded, with no attempt to homologize "horns" among species.

Luxbacher and Knouft (2009) included "occipital horn length" among the morphological variables examined in their analysis of the relationship between morphology and environmental factors across geographical ranges of all species of *Phrynosoma* then recognized.

Leaché et al. (2009), in examining the *Phrynosoma coronatum* species group, used geometric morphometric methods to capture shape variation in the "posterior superciliary horn", the "interoccipital horn", the "occipital horn", and the "posterior temporal horn". In so doing they assumed homology between taxa with regard to these asperities and found that horn shape was, to some degree, associated with their species delimitations.

Bergmann and Berk (2012) examined the allometry of "horns" of *Phrynosoma*, using a phylogenetic approach. They restricted their definition of "horn" to those asperities arising from the squamosal, the parietal and the posterior lateral process of the frontal, documented the cranial element from which each asperity arose and its position on that element, using the nomenclature established by Powell et al. (2002). They thus hypothesized interspecific horn homology, noting, however, that such putative homology required further ontogenetic testing.

Barajas et al. (2013), in examining the subspecific taxonomy of *Phrynosoma orbiculare*, included "occipital horn" length and the lengths of two of the temporal "horns" among the morphometric characters used in their analyses. "Supercilliary scale length" was also employed, but it is not clear if this represents the asperities arising from the posterior lateral process of the frontal.

Moreno-Barajas et al. (2013) conducted a geometric morphometric analysis of variation in external head shape among the subspecies of *Phrynosoma orbiculare* and included "*los cuernos temporales y occipitales*" ("the temporal and occipital horns") and "*las escamas superciliares*" ("superciliary scales") among their landmarked features. The latter are the asperities arising from the posterior lateral process of the frontal. They collected data for three squamosal asperities.

Nieto-Montes de Oca et al. (2014), in their description of *Phrynosoma sherbrookei*, distinguished it from its congeners by the number and morphology of its occipital and temporal "spines", and particularly from *P. taurus* by the relative sizes of the "outer temporal spines", which implies the assumption of interspecific homology of these asperities.

Montanucci (2015) revised the *Phrynosoma douglasii* complex, using external characters. Among these were lengths of the occipital and temporal "horns" and the "superciliary spine", considered to be homologous among the taxa comprising this complex. He noted relative sizes and orientations of "cephalic horns", and particularly compared the "third temporal horn" between taxa, assigning it an identity.

Powell et al. (2017), in a geometric morphometric analysis of dermatocranial shape in *Phrynosoma hernandesi*, used Powell et al's (2002) nomenclature for horns. They assumed homology of the squamosal and parietal horns of all species of *Phrynosoma*.

Sherbrooke et al. (2022) expanded upon Sherbrooke's (1987) previous examination of the "horns raised" defensive posture exhibited by species of *Phrynosoma*, extending this survey to *P. ditmarsi*. They posited that this behavior is, along with dermatocranial "horns", plesiomorphic for the genus. "Horns" were implicitly recognized by these authors as phylogenetic homologues having identity.

Powell and Russell (2023) presented a definition of "horns" applicable to all species of *Phrynosoma*. A phylogenetic analysis of horn number based upon this definition revealed a plesiomorphic horn array, each horn of this array being evolutionarily homologous among all extant species. Ontogenetic and morphological data permitted exclusion of asperities that had previously been recognized as horns in *P. modestum* and *P. ditmarsi*. Evolutionary recruitment of tubercles as additional horns was posited for *P. solare* and the Brevicauda species.

Synopsis by Century

17th Century: First published accounts. Recognition of an ornamented head.

18th Century: Initial formal classification. First inklings that the cranial armature differs qualitatively from the spiny scales elsewhere on the body.

19th Century: Increasing recognition of diversity of the genus and of diversity of cranial asperity expression — species-specific patterns tentatively recognized with possibilities for phylogenetic significance. Bony cores of the cranial asperities recognized. First inklings that the horns might be individual structures with homology across species and specific locations on particular cranial elements.

20th Century: Suggestion/speculation of individual homology of specific asperities continues. Thoughts about ancestral and derived states expressed. Assignment of fossil forms to extant taxa based upon features of the asperities. Suggestions of evolutionary transitions between horn configurations. Advancement of the idea that horns are a synapomorphy of the genus.

21st Century: Individual horns identified and named for *P. orbiculare*. Horn homology of parietals and squamosals posited as a testable hypothesis. Horns designated as a suite of discrete structures and a plesiomorphic horn array

identified. Establishment of horn homologies across the genus sets the stage for the analysis of the evolution of cranial armature and a more explicit association with behavioral traits.

Conclusions

The collective common name in English for *Phrynosoma* is "horned lizards", implying that dermatocranial horns constitute a salient feature. Our review of the historical literature, however, reveals that a variety of terms have been applied to the cranial ornamentation of *Phrynosoma*. These horns, in English and in other languages, have not generally been considered to be of great taxonomic utility, except as a defining characteristic of the genus as a whole (Etheridge and de Quieroz, 1988). Differences in horn number, shape and size have been noted by various authors, suggesting a tacit denomination of horns as interspecific homologues. However, a general lack of attention to the nature of *Phrynosoma* horns — their osteological origins in particular — has rendered them of limited value as characters. The plethora of names applied to them, and the inconsistency of appellation, may also have contributed to this.

Overall, illustrations of phrynosomes, or parts thereof, in the literature prior to the 20th Century show variable levels of attention to detail regarding the cranial asperities for which *Phrynosoma* is known. Generally there has been a lack of association between the external manifestation of form and underlying skeletal structure, rendering unambiguous comparison between species problematic.

Pianka and Parker (1975) proposed that the adoption of myrmecophagy by the common ancestor of *Phrynosoma* promoted the co-evolution of a suite of morphological, physiological and behavioral characteristics, among which are defensive cranial horns. Various studies have since examined corollaries of this hypothesis: variation in trophic anatomy and its correlation with degrees of myrmecophagy among the species of *Phrynosoma* (Montanucci, 1989; Sherbrooke and Schwenk, 2008; Meyers et al., 2006, 2017); the relationship between the percentage of ants in the diet of individual species and overall horn length (Meyers et al., 2006, 2017); phylogenetic covariation between body form, sprint speed and longest horn length in species of *Phrynosoma* (Bergmann et al., 2009); and phylogenetic relationships between body form, limb length, occipital horn length and ecological niche (Luxbacher and Knouft, 2009). However, these studies either considered horn length in the qualitative aggregate (Montanucci, 1989; Meyers et al., 2006, 2017), did not consider interspecific homologies of the longest horn (Bergmann et al., 2009), or examined variation in only one horn (Luxbacher and Knouft, 2009). Bergmann and Berk's (2012) phylogenetic analysis of horn allometry within *Phrynosoma* explicitly treated individual horns as evolutionary homologues, although assignment of homologues was not always correct (Powell and Russell, 2023).

The horns of *Phrynosoma* have generally been regarded as unique defensive structures (Pianka and Parker 1975; Munger, 1986; Greene, 1988; Baur and Montanucci, 1998; Bergmann and Berk, 2012; Sherbrooke, 1987, 1990, 1991, 2003, 2008, 2013; Young *et al*., 2004). The common ancestor of the genus is hypothesized to have had the full plesiomorphic horn number (Powell and Russell, 2023), with the longest of these being of substantial length (Leaché and McGuire, 2006). The ubiquity of horns among the species of this genus, and their role in defense, speaks to their importance. Phylogenetic patterns of horn growth (Leaché and McGuire, 2006; Bergmann and Berk, 2012) and disparity in horn length and number in extant species (Powell and Russell, 2023) indicate that the evolution of horn morphology has been complex. Further phylogenetic studies of the co-evolved *Phrynosoma* suite will benefit from incorporating data on the entire horn arcade with confident assignment of homology among individual horns, allowing a deeper understanding of the features that give the genus its common name.

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The Cartographer's Turtle: The Grotesque Origins of Renaissance Map Turtles

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Amongst the late sixteenth-century watercolor drawings of Dutch fisherman Adriaen Coenen can be found a sea creature: A flying turtle Coenen called the "sea-eagle" whose origins have yet to be firmly ascertained. Some historians have traced its ancestry as far back as two Renaissance maps dated to 1558 (Van Duzer 2013). Another instance, Flemish engraver Cornelis Bos' 1548 frieze *The Triumph of Neptune*, has yet to be described in the context of the "sea-eagle" and is reported here. Together, these examples establish the genesis of this Dutch *zeemonster* in an ornamental art style known as the Netherland Grotesque that emerged ca. 1540 and was pioneered by Flemish artists and their re-imagination of Italian grotesques. By tracing the history of these Renaissance maps and Bos' frieze, the emergence of the "sea-eagle" is re-considered against the backdrop of the advent of the Netherland Grotesque.

The "Sea-Eagle"

The "sea-eagle" (*zee arent* in Dutch) first gained notoriety — and it's descriptive nickname — in the *Visboeck* (1577–1579) and *Walvisboeck* manuscripts (1584), the re-discovered works of Dutch fisherman-cum-lay-artist Adriaen Coenen (1514–1587), a figure who has received increasing attention in recent years (Coenen 1577–1579, Coenen 1584; see Egmond 1997, Egmond and Mason 2003, Egmond 2018). These manuscripts consisted of bound books that collected and presented watercolor drawings and natural history accounts of known and fictional sea creatures; all were unabashedly copied from earlier texts written by the likes of Pliny and Aristotle, among others, and were showcased to the paying public (Egmond 1997, Egmond and Mason 2003, Egmond 2018).

Amongst these sea creatures was an animal Coenen described and depicted as a "sea-eagle" (Fig. 1). The text that accompanied this watercolor drawing described a local Dutchman who captured "*eenen grooten sciltpadde*" (a large tortoise/turtle) with a beak like an eagle, wing-like fins, and a big shell like a turtle. Later in the passage, Coenen mentioned a second "sea-eagle" he witnessed in the city Delft (Netherlands) and a third in Schiedam (Netherlands) (Coenen 1577–1579). Little in the text justifies how one might mistake a sea turtle for a "sea-eagle" except the base assumption that a sea turtle's flippers might be mistaken by some for wings. And it seems apparent that despite the fanciful name Coenen offered, he was most likely describing an actual sea turtle in the running text.

Considering this illustration as a standalone object copied from earlier texts, where then did the image of the "sea-eagle" originate?

The Map Turtle

Until recently, the "sea-eagle's" first appearance (Fig. 2) had been traced to the seas of two Renaissance maps of Scandanavia: Arnold Nicolai's 1558 *Caerte van oostlant* (Nicolai 1558) (Fig. 3) and Michaelis Tramezzino's 1558 *Septentrionalium Regionum Suetiae Gothiae Norvegiae Daniae et terrarum adiacentium recens exactaque description* (Tramezzino 1558) (Fig. 4). Both maps represent later editions (=copies) of an earlier map, mapmaker Cornelis Anthoniszoon's (also, Anthonisz) original "first" edition 1543 *Caerte van oostlant* of which no physical copies exist today (Lang 1986, Van Duzer 2013). Both the Nicolai and Tramezzino editions feature a "sea-eagle" in their respective top left panels (Fig. 5).

Anthoniszoon's original 1543 *Caerte van oostlant* is considered the "first" edition; Anthoniszoon published a "second" edition of the same map, presumably in Amsterdam prior to 1553. Based on a careful analysis of each subsequent map's style, the rendering of specific details, and characteristic lettering, cartographers have been able to ascertain that the 1558 Tramezzino edition (considered the "Venice" edition) is most likely an exact copy of Anthoniszoon's original 1543 "first" edition, while the 1558 Nicolai edition (considered the "third" or "Antwerp" edition) most likely reflects revisions made by Anthoniszoon himself to the individual printing blocks that comprised earlier editions of his own map (Lang 1986, Schilder and van Egmond 2007).

Maritime cartographer and scholar Arend Wilhelm Lang described the 1558 Tramezzino edition as, in his words, *eine genaue Kopie* ("an exact copy") (Lang 1986) of Anthoniszoon's original 1543 "first" edition. Presumably, this would include artistic embellishments such as sea monsters as well. Although both the Tramezzino and Nicolai editions were based on different versions of Anthoniszoon's work, they were published contemporaneously in 1558. In comparing the two briefly, Tramezzino's *zeemonters* are exceptionally detailed

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Fig 1. Adriaen Coenen's "sea-eagle" from the *Visboeck* (Coenen 1577–1579) (Courtesy of the Koninklijke Nationale Bibliotheek) (Left) and Walvisboeck (Coenen 1584) (Courtesy of the Erfgoedbibliotheek Hendrik Conscience, Bruikleen Koninklijke Maatschappij voor Dierkunde Antwerpen) (Right).

compared to Nicolai's more crude, childlike representations. Other than a ship here or there, the seas in both maps are otherwise equally populated with the same assortment and placement of *zeemonsters* with only an extra *vorago* (a "whirlpool") off the coast of Norway to distinguish the Tramezzino edition apart (at least, with respect to *zeemonsters*).

In cartography historian Chet Van Duzer's *Sea Monsters on Medieval and Renaissance Maps*, he posits that the then-unnamed flying turtle depicted in the top left panel of Nicolai's 1558 map (Fig. 5; left) was a reference to the map publisher, whose cartouche in the bottom right panel — which reads "Antwerpiae per Arnoldum Nicolai, ad insigne Testudinis" ("In Antwerp by Arnold Nicolai at the sign of the turtle") — was surrounded by four turtles (Fig. 6) (Van Duzer 2013). This explanation, however, seems unlikely since there is little likeness between the "sea-eagle" and the turtles in the cartouche. Furthermore, if Lang's assessment is correct that Tramezzino's 1558 "Venice" edition is an exact copy of Anthoniszoon's original 1543 "first" edition, then the origins of the "sea-eagle" would predate the cartouche.

Based on a review of representative works by Anthoniszoon, the depiction of grotesques or *zeemonsters* appears atypical of his work.

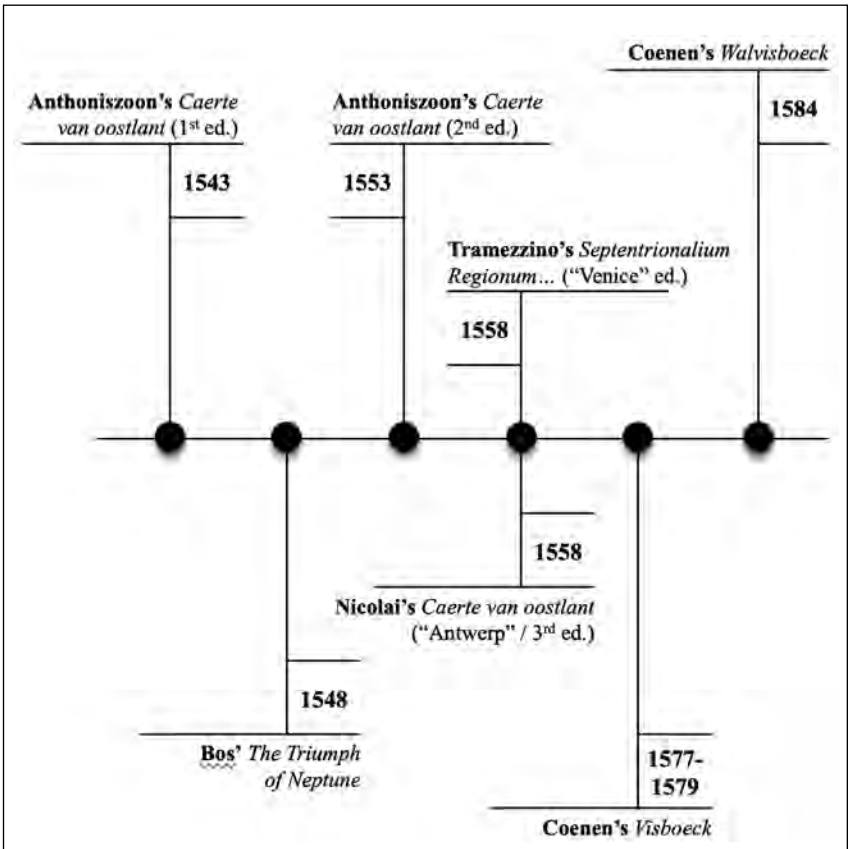

Fig 2. A timeline of early depictions of the "sea-eagle" in Renaissance maps and artwork in the style of the Netherland Grotesque.

Fig 3. Arnold Nicolai's 1558 *Caerte van oostlant* (Nicolai 1558) (Courtesy of Herzog August Bibliothek Wolfenbüttel).

The sterile seas surrounding another of Anthoniszoon's maps, his 1544 (or ca. 1557) *Plattegrond van Amsterdam* (Map of Amsterdam) (Rijksmuseum; object number RP-P-AO-20-15), for example, are barren of any sea creatures at all. The one exception attributed with uncertainty to Anthoniszoon between 1509 and 1553, the engraving *De strijd tussen goed en kwaad* (The battle between good and evil) (Rijksmuseum; object number RP-P-Bl-128) (Fig. 7), depicts the entrance of hell as the mouth of the mythological sea serpent Leviathan, a creature illustrated not unlike some of Bos' sea monsters.

To be fair, without a copy of Anthoniszoon's 1543 "first" edition *Caerte van oostlant* at hand, the appearance of a "sea-eagle" therein cannot be verified. That leaves Tramezzino and Nicolai's later editions of Anthoniszoon's *Caerte van oostlant* as the only evidence the genesis of the "sea-eagle" originated with his 1543 map.

This very same "sea-eagle" appeared in later maps as well, all clear copies: Abraham Ortelius' 1564 *Nova Totius Terrarum Orbis Iuxta Neotericorum Traditiones Descriptio* (world map) (Ortelius 1564) and 1567 *Asiae orbis partium maximae nova descriptio* (map of Asia) (Ortelius 1567); and Michaelis Tramezzino's 1567 *Septentrionalium Regionum Suetiae Gothiae Norvegiae Daniae et terrarum adiacentium recens exactaque descriptio* (map of Scandanavia) (Tramezzino 1567). Notably, it isn't until Ortelius' 1567 map of Asia that the "sea-eagle" is first given a name at all (of sorts), labeled the *testudo volatilis* (flying turtle) (Ortelius 1567).

Cornelis Bos

Cornelis Bos (c. 1506/10–1555) was a Flemish engraver, print seller, and publisher who was once credited as having initiated the style of the Netherland Grotesque, a credit that has since been debunked and attributed instead to Flemish engraver Cornelis Floris (Schéle 1965; see Hedicke 1913). The term "Netherland Grotesque" (aka. the "Floris Style") describes an ornamental style characteristic of the Netherlands in the 1540s and 1550s best exemplified by the work of Floris, Bos, and Pieter Coecke van Aelst (Schéle 1962). Its emergence, which took root in Rome ca. 1540 in imitation of Italian grotesques, arose in tandem with the rise in Dutch

Fig 4. Michaelis Tramezzino's 1558 *Septentrionalium Regionum Suetiae Gothiae Norvegiae Daniae et terrarum adiacentium recens exactaque description* (Tramezzino 1558) (Courtesy of University Library at UiT, The Arctic University of Norway).

trade overseas, a timing evident through its convergence of the Italian *grottesca*'s fanciful distortions of human, animal, and plant forms together with maritime's bevy of bizarre sea creatures (Schéle 1965).

Although much of Bos' whereabouts remain uncertain throughout his life, scholars believe that, after fleeing Antwerp in 1544 because of his association with a spiritualist sect, he settled for a brief time in Rome ca. 1548. During his stay, Bos created engravings of motifs found in the ornamental frescoes of the Vatican loggias in the Apostolic Palace, Vatican City, Italy. Such prints were intended for sale in the Netherland market (Schéle 1965). Sixteenth-century Italy and the Netherlands were among the key regions where art and the art markets blossomed during the Renaissance. There, paintings and prints were sold by artists and dealers to collectors and merchants in the streets, annual-to-year-round outdoor fairs, indoor shops, and stalls in exchange buildings (De Marchi and Van Miegroet 2006).

One of Bos' friezes, considered by Bos scholar Sune Schéle "by far the most important both technically and from the point of view of composition", exceeds a work of mere reproduction and represents instead his attempt to "merge impressions from [Andrea] Mantegna and Giulio Romano into a version of his own" (Schéle 1965). The engraving in question, *The Triumph of Neptune* (Bos 1548), is a frieze of three consecutive sheets (each 140 x 330 mm) signed and dated 1548 (Fig. 8). Across the three views that comprise the frieze are the Roman god Neptune and his tritons/mermen astride their serpent-tailed and web-footed sea-horses, all amidst a swirling host of fabulous-but-grotesque sea creatures. The unnamed *zeemonsters* found amongst this menagerie included a reimagined swordfish and dolphins together with far less fantastical sea snails, a lobster, and a sea turtle. And trapped in the vaulted skies overlooking this melee of monsters hangs a curious winged turtle (Fig. 9).

Neptune's Muse

The two previously mentioned artists that scholars credit as the inspiration behind Bos' *The Triumph of Neptune* are Andrea Mantegna and Giulio Romano (Schéle 1965). Italian painter Andrea Mantegna's (c. 1431–1506) work includes two

Fig. 5. Detail of flying turtles from Arnold Nicolai's 1558 *Caerte van oostlant* (Nicolai 1558) (Courtesy of Herzog August Bibliothek Wolfenbüttel) **(**Left**)** and Michaelis Tramezzino's 1558 *Septentrionalium Regionum Suetiae Gothiae Norvegiae Daniae et terrarum adiacentium recens exactaque description* (Tramezzino 1558) (Courtesy of University Library at UiT, The Arctic University of Norway) **(**Right**)**.

Fig. 6. Detail of Arnold Nicolai's 1558 *Caerte van oostlant* (Nicolai 1558), which features four turtles and the notation "Antwerpiae per Arnoldum Nicolai, ad insigne Testudinis" ("In Antwerp by Arnold Nicolai at the sign of the turtle") as part of the publisher's cartouche (Courtesy of Herzog August Bibliothek Wolfenbüttel).

mythological copper engravings, collectively named *The Battle of the Sea Gods*, engraved some time before 1494 as compositions that can be connected to form a single scene. The pair includes *The Battle of the Tritons* (left), which features Neptune, Invidia (Envy), and sea-horses, and *The Battle of the Sea-Centaurs* (right), which features sea-centaurs. Presumably, all such figures were copied from ancient monuments (Kristeller 1901). Elements of Mantegna's *The Battle of the Sea Gods* are reflected in Bos' *The Triumph of Neptune*, but Mantegna's work pre-dates Bos and the Netherland Grotesque by a half century, and nowhere amongst this host of sea gods are any grotesque-worthy sea creatures.

Italian painter Giulio Romano (c. 1499–1546) is the second artist to whom Bos' inspiration is credited. Romano's own *Triumph of Neptune* painting, *Nettuno circondato da Tritoni con rapimento di donne* (*Neptune surrounded by Tritons with abduction of women*), said to have once hung in the house of Giovanni Vincenzo Imperiale at Genoa some time before 1661, has since been lost (Hardtt 1981). A drawing believed to be the preparatory study for this painting is held today in the Devonshire Collection of the Chatsworth House (catalogue number 301; see Hardtt 1981, p 278, Fig. 530). Elements of Romano's

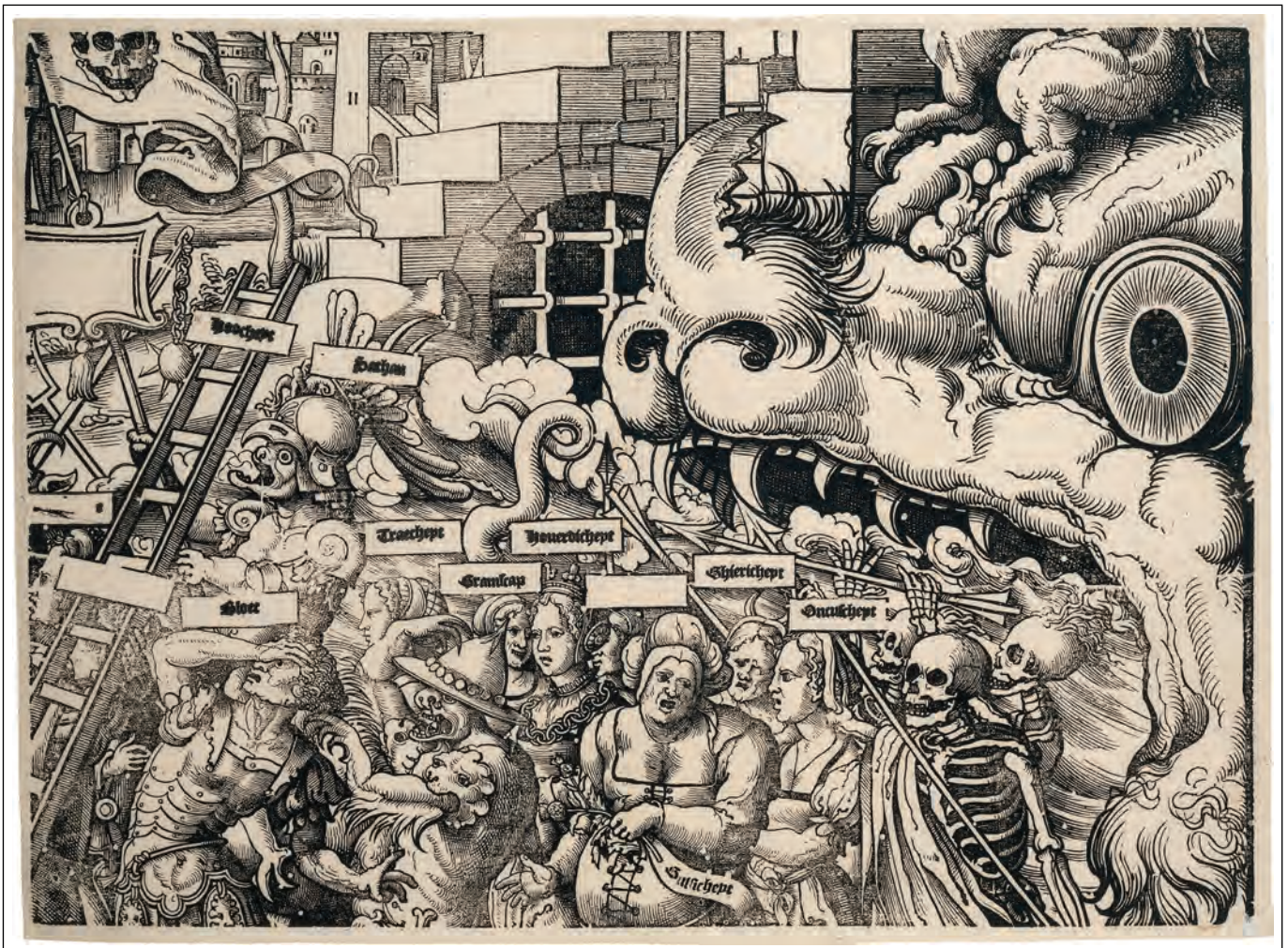

Fig. 7. The engraving *De strijd tussen goed en kwaad* (1509–1553) is attributed to Cornelis Anthoniszoon, and includes a depiction of the mythical sea serpent Leviathan that shares a loose resemblance to *zeemonsters* that appear in later copies/editions of Anthoniszoon maps (Anthoniszoon 1509–1553) (Courtesy of Rijksmuseum, Amsterdam).

Nettuno circondata da Tritoni… are also reflected in Bos' *The Triumph of Neptune* and it may have been synchronously prepared with Bos' friez, but nowhere in the undated drawing are any grotesques to be found.

Did Bos find inspiration in either Mantegna and Romano's works? Mantegna clearly pre-dates the emergence of the Netherland Grotesque, while Romano's twilight years overlap it by a matter of years. In reviewing both artists' oeuvres, grotesques do not figure prominently in Mantegna's catalogue (see Kristeller 1901), but do appear with greater frequency in Romano's catalogue (see Hardtt 1981). Nevertheless, the creatures in Mantegna's *Battle of the Sea Gods* and Romano's *Nettuno circondata da Tritoni…* are limited to sea-horses and sea-serpents. Neither artist appears to have left behind the blueprint material that might have influenced Bos' conception of a winged turtle, suggesting that, at least within the sphere of the art world, the "sea-eagle" may have first found flight during the emergence of the Netherland Grotesque.

Flight of Fancy?

This image of the "sea-eagle" seen in Renaissance maps and artwork in the style of the Netherland Grotesque can be interpreted in several ways. First and foremost, that of a sea turtle breaking through and floating on the surface of the ocean. Under this interpretation, the viewer can make out these sea turtles' scaled fore flippers extended for stability, each studded with one to two claws. The second and more fanciful interpretation is that of a winged turtle depicted in a bird-of-prey-like "kiting" posture[1] [When a hawk holds their wings aloft in such a way as to use air currents to maintain "lift" or a stationary position in the sky, rather than by flapping their wings.]. Under this alternative interpretation, the viewer can make out these sea monsters' foot-like, grasping clawed talons, the distinct patagium-like skeleto-musculature on the leading edge of the forelimbs, and featherlike distal appendages. This latter interpretation is seemingly reinforced by Ortelius' 1567 map of Asia in which it is labeled the *testudo volatilis* (flying turtle) (Ortelius 1567) and Coenen's ca.

Fig. 8. Cornelis Bos's 1548 frieze *The Triumph of Neptune* (Courtesy of Rijksmuseum, Amsterdam).

Fig. 9. Detail of the flying turtle from Cornelis Bos's 1548 frieze *The Triumph of Neptune* (Courtesy of the Rijksmuseum, Amsterdam).

1577–1579 reproduction of, and nomen novum for, the "sea-eagle" (Coenen 1577–1579).

Grotesque Origin Story

Through Coenen's connection with the sea, he may very well have chanced upon any one of the maps of Amsterdam described above during the preparation of his ca. 1577–1579 *Visboeck* manuscript. Based in the Dutch village of Scheveningen but a frequent visitor of The Hague in the Netherlands, it is also likely that Coenen may have come across Bos' *The Triumph of Neptune* engraving for sale in the streets. But one or the other, or any subsequent reproduction of this imagery, likely served as inspiration for Coenen's "sea-eagle" illustration.

Together, these examples establish the genesis of this Dutch *zeemonster* in the ornamental art style known as the Netherland Grotesque in which the image of the sea turtle was reimagined for a time as a sea monster, sparking the imagination of mariners and artists and naturalists alike for years to come. The inclusion of *The Triumph of Neptune* by one of the forefathers of this ornamental style amongst the ranks of Renaissance maps helps establish these roots. Today, such illustrations provide a window into the past to an age when there were still corners of the world as yet unexplored, wildlife as yet undescribed, and one's imagination as yet unchecked. Leaving room enough to believe — if only for a moment — in a flying turtle.

Acknowledgements

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Waldo McAtee and the Herpetological Portions of *Nomina Abitera*, 1945 and *Supplement to Nomina Abitera*, 1954

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"There appears to be among mankind an innate tendency toward ribaldry." McAtee, 1945:1

"Those hardy enough to conquer the wilderness usually left upon it the impress of a rich vocabulary" McAtee, 1945:1

A Brief Biographical Sketch of Waldo McAtee

Waldo Lee McAtee (Fig. 1) was born in Jalapa, Indiana on 21 January 1883, and spent his adult life as an employee of the United States Biological Survey, conducting field and laboratory research, building and studying collections, and leaving, upon his death in 1962, an impressive catalogue of published and unpublished works that continue to provide fertile ground for inquisitive minds in many disciplines. His interests and activities were diverse and when paired with his energetic approach to work gave rise to an eclectic mix of publications spanning ornithology, entomology, botany, conservation, folklore, literature, poetry, and esoterica. He left an unpublished record of his childhood memories written in longhand that is deposited at the Library of Congress in Washington, D.C. It is an unusually candid set of recollections that touches on many aspects of being raised in family of (as he recalled it) "modest financial status," that moved repeatedly in his early years from one residence to another and ended up in Marion, Indiana during a peak in industrial development following the discovery of natural gas in the region.

McAtee's interest in animals began at a young age when he tried (and failed) to raise rabbits, but at the age of sixteen his first publication appeared in the Marion Indiana High School Journal, a review of a paper on feeding habits of birds (Terres, 1963). McAtee was encouraged by two of his high school teachers to develop his interest in biology (Kalmbach, 1963; Kimler, 2008), and he focused on pursuing a career in zoology after being inspired by lectures given by ornithologist Frank M. Chapman (Terres, 1963). McAtee worked his way through college at the Indiana University and between 1901 and 1904 served as curator of the bird collection in the museum there. He earned his A.B. degree in 1904 and went on to complete the A.M. degree in 1906. Between his third and fourth years as an undergraduate he was temporarily appointed at the Bureau of Biological Survey. A permanent appointment followed after his graduation in 1904, and he continued to work at the Biological Survey for the rest of his career. His field work was conducted in 40 states, two Canadian provinces, and twelve European countries (Alcock, 1956; Terres, 1963). In 1921 he became the head of Food Habits Research at the Survey. Food habits of North American birds were, at that time, inadequately understood, and McAtee made major contributions to documenting diets of birds (Reeves, 1984). McAtee's studies on insectivory in birds led him into controversy over the question of 'adaptive (or protective) coloration' and its role in natural selection, particularly in relation to the dietary habits of birds. His early thoughts on the topic were published in 1912. In a somewhat abrasive way, McAtee called into question conclusions that had been drawn from anecdotal evidence and from experiments conducted on birds in captivity, which he was convinced was an inadequate reflection of behavior in the wild (McAtee, 1912). He noted that the "principal failing of the selectionists always has been a vast ignorance of what wild birds really eat" (McAtee, 1912:313) and stated that the stomach contents of approximately 48,000 birds held in the collection of the U. S. Biological Survey were "practically the only large body of authentic information on the natural food habits of birds" (McAtee, 1912:313). One of McAtee's major works was an expanded study of the stomach contents of over 80,000 birds (McAtee, 1932a); it stimulated sharp criticism and alternative interpretations of McAtee's data (e.g., Burt, 1932) but experimental data in support of mimicry were only slowly developed (Evans, 1965). One of the pointed responses to the 1932 paper came from E. R. Dunn (1935) in a lengthy commentary published in *Copeia*. McAtee penned a response to Dunn (1935) and submitted it to *Copeia*, but the response was rejected because it dealt "entirely with birds and mammals" and was privately published instead (McAtee, 1935b:[1]). His other papers addressing evolutionary theory included an additional commentary on warning colors and mimicry (McAtee, 1933b [a review of Cott, 1932, who later published an extensive rebuttal and critique of McAtee's ar-

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guments (Cott, 1940: 168–171)]), a proposal for using numerical abundance as a metric for identifying successful species (McAtee, 1949), and commentaries and criticisms on natural selection (e.g., McAtee, 1937a; 1939b; 1943a) and 'the Malthusian principle in nature' (McAtee, 1936).

Although he described himself as unsociable (Kalmbach, 1963), and was characterized as "shy and antisocial" (Lannoo, 2018:144), McAtee engaged in considerable professional service throughout his career and was a member of at least 30 different societies that reflected the breadth of his academic interests (Kalmbach, 1963). He was egalitarian in his social and professional interactions and was uncomfortable in leadership roles that, of necessity, suggested a hierarchical superiority. He was reported to be "a man who would rather be right than be Chief" (Sterling, 1997:519; see also Terres, 1963) and he preferred to operate behind the scenes where possible. Nonetheless, he served as Secretary of the Washington Biologists' Field Club in 1909 (according to Kalmbach, 1963, but possibly just after 1909[?]; no Secretary was listed between 1909 and 1913 by Perry, 2007:x) and Vice-President of that club from 1913 to 1914 (Perry, 2007). He was especially active in the American Ornithological Union (AOU), serving in various roles, but most significantly as treasurer and member of the Committee on Publications from 1920 through 1938 (he first appeared in the list of officers in the April 1921 issue of *The Auk*, and dropped off the list in the April 1938 issue). His ties with the AOU faded in the early 1940s when many of the early members died and McAtee felt less attachment as the membership grew (Kalmbach, 1963).

McAtee was the founding editor for *Wildlife Review* and served in that capacity from 1935 through 1947. He helped to found the Wildlife Society in 1936 and was the founding editor for *Journal of Wildlife Management* from 1937 through 1942. From 1940 to 1947 he also served as technical advisor and senior editor for the U.S. Biological Survey and for a few years for its successor organization, the Fish and Wildlife Service (Alcock, 1956). In the early 1940s, he was technical advisor for *Nature Magazine*. He was widely recognized for his editorial work (Kalmbach, 1963) and was declared by one of his contemporaries to be "one of the most capable biological editors of his time" (Stoddard, 1969:230). In a more recent characterization of him, Lannoo (2018:144) concluded that he was "energetic, competent, methodical, effective, independent, and courageous."

McAtee's direct and honest approach ultimately probably led to his dismissal in 1934 as head of the Food Habits Research section of the Biological Survey, a position he had held since 1921. Following the resignation of Paul Redington as Chief of the Bureau of Biological Survey, a need for a successor was exigent. Candidates for the position from within the bureau, including McAtee, were not acceptable to then-Secretary of Agriculture Henry A. Wallace. Roosevelt asked J. N. 'Ding' Darling to take over (Lendt, 1979:69). McAtee openly opposed the appointment of Darling as head of the Biological Survey, and went so far as to craft a report 'detailing Darling's incompetence" (Lannoo, 2018:142). Darling was appointed in spite of those concerns, and when he was shown the report, Darling was surprised that the information had been "overlooked" and that he *had* been appointed (Lendt, 1979:70). McAtee remained at the Biological Survey and simply redefined his role there, becoming a rich source of in-house information for wildlife research; he was considered to be "better informed on more groups of organisms than any man in the history of the Bureau of Biological Survey and its successor the Fish and Wildlife Society" (E. A. Prebles in Reeves, 1984:86).

Fig. 1. Waldo Lee McAtee. Date unknown. Photo courtesy of Kraig Adler.

McAtee was a prolific writer, a keen observer, and something of a connoisseur of human behavior, especially of those with whom he interacted most. In additional to his handwritten autobiographical notes about his childhood, McAtee left to the Library of Congress 374 hand-written pages of unpublished notes containing a wealth of information and his personal reflections about the U.S. Biological Survey and its members. Some of that commentary has now emerged in print (e.g., Schmidly, et al., 2016) but access was restricted until a particular individual he discussed was dead (Kalmbach, 1963; Schmidly and Tydeman, 2016). McAtee was di-

rect and sometimes came off as quite critical in his personal interactions. That simultaneously made for some difficult interactions, but also for a widespread appreciation for his honesty and integrity (Terres, 1963; Kimler, 2008). He made clear his opinions on issues and left no room for ambiguity in understanding his position, even when a softer approach might have been more helpful (Kalmbach, 1963).

Research Interests and Output

One of the principal areas of interest in his career was the economic impact of birds on agriculture and related fields. He began developing data in that area at an early age. The thesis he submitted as part of the degree requirements for his Master's addressed the agricultural impacts of the horned lark and was already published (McAtee, 1905) before he completed the degree. It served as a launching point for his remarkable career as a self-titled "economic ornithologist" (McAtee, 1932b; he defined economic ornithology as "all relations of birds that have any bearing upon the material welfare of man" [McAtee, 1933c:111]). Estimates of his published output vary between his several biographers, but his mainstream scientific papers numbered in the hundreds and total written contributions were in the thousands. The number of scientific papers, including obituaries and reviews, was given as 902 by Terres (1963), 896 by Kalmbach (1963) and 850 by Alcock (1956); Smith (2005) estimated that his total output "cannot be much less than 1500 items," and Terres (1963) and Reeves (1984) gave an estimate of 1,200 to 1,300; those estimates do not include the over 6,000 article abstracts he produced as editor of *Wildlife Review*. He certainly was best known and recognized for his contributions to knowledge on the food habits of birds, especially on the North American continent. In part as a result of his extensive work on stomach contents, McAtee attained proficiency with insect identification, and was well-regarded as an entomologist; he described 20 genera and 466 new species of insects (Reeves, 1984) and served as acting curator of Hemiptera at the U. S. National Museum from 1920 to 1942 (Smith, 2005). McAtee retired in 1947, and moved to Chapel Hill, North Carolina in 1950. In 1954 he was elected the first Honorary Member for Life of the Carolina Bird Club, to whose journal he had contributed 11 papers, including a series on the common names of birds in the Carolinas (Quay, 1962; Potter, 1986). In 1961 he was awarded an honorary doctoral degree from Indiana University (Kalmbach, 1963); two genera and 13 species of insects, plus one plant, were named after him (Reeves, 1984). He died of cancer in 1962 and was cremated.

It is abundantly clear that McAtee's work in ornithology and entomology were much more extensive than his work in herpetology and other fields. Although I make no claim to this being a complete list, I am aware of only four of his works that directly focus on herpetological subjects (Banta and McAtee, 1906; McAtee, 1921; McAtee, 1933a; McAtee, 1944)—two addressing salamanders, one an anuran, and one the Timber Rattlesnake—and ten others that contain significant herpetological content (McAtee, 1907; Beal and McAtee, 1912 (revised and reprinted 1922); McAtee, 1912; McAtee, 1918; McAtee, 1932a; McAtee, 1934; McAtee, 1935a; McAtee, 1939a; McAtee; 1941a; McAtee, 1941b). Two of the latter group (1939a and 1941b) carry the same title but were published as circulars for two different government departments (Department of Agriculture [1939a] and Department of the Interior [1941b]); the single herpetological plate that appeared in both is identical, as is most (but not all) of the text. Two of the publications (1907, 1918) are surveys of geographic areas (Monroe County, Indiana and Washington, D.C., respectively) and herpetological taxa are included. Two (1912, 1932a) are criticisms of the selective advantage of protective coloration, and include amphibians and reptiles as exemplars of both predator and prey in that context. One includes a summary of amphibian and reptile species in the United States that either have commercial value or are generally considered 'vermin' (1934), and one (1941a) is a brief commentary on regional variation in biological nomenclature that and includes discussion of the American Bullfrog (*Rana catesbeiana*). The remaining two (Beal and McAtee, 1912/1922; McAtee, 1935a) are surveys of the prey items in birds. Beal and McAtee (1912) included frogs and small lizards in stomachs of red-bellied woodpeckers (p. 11/p. 9 in 1922 revised version), tree frogs in the stomach of an Arkansas kingbird (p. 19/17), and lizards eaten by a western shrike (p. 31/29). The 1935a paper by McAtee addressed food of common hawks in North America; most of the herpetological entries are categorical (along the lines of 'they eat frogs, lizards, turtles, and snakes'), but *Sceloporus*, *Anolis*, *Phrynosoma*, and *Storeria* are specifically called out (p. 35) as prey items of the sparrow hawk (now American kestrel, *Falco sparverius*). In other cases, generic or specific names can be inferred from common names provided in the text (pp. 20, 27, 33). At least two of his literature reviews touch on herpetological topics (McAtee, 1937b, 1941c). Other incidental mentions of herpetological subjects include a note that anuran calls are sometimes mistaken for bird calls (McAtee, 1923), the occurrence of 66 anuran bones in a sample of lake drift from North Dakota (1925), a note on shed snake skins used in bird nests and nest boxes (McAtee, 1940) a list of names with the roots 'snake,' 'lizard,' and 'toad' applied to birds (McAtee, 1955a), and a few notes on herpetological aspects of American folklore (McAtee, 1943b, 1951, 1955b).

Another of McAtee's areas of active research and publication was centered on nomenclature, and especially vernacular names in biology. More than 35 of McAtee's published works specifically focused on bird, insect, and plant names (Anonymous, 1962) and he maintained a long-standing interest in dialects and especially 'unconventional' practices in use of common and scientific names in biological nomenclature. This dated back to the early years of his professional career and extended throughout his years as a prolific writer. He began compiling data on folkloric nomenclature as early as

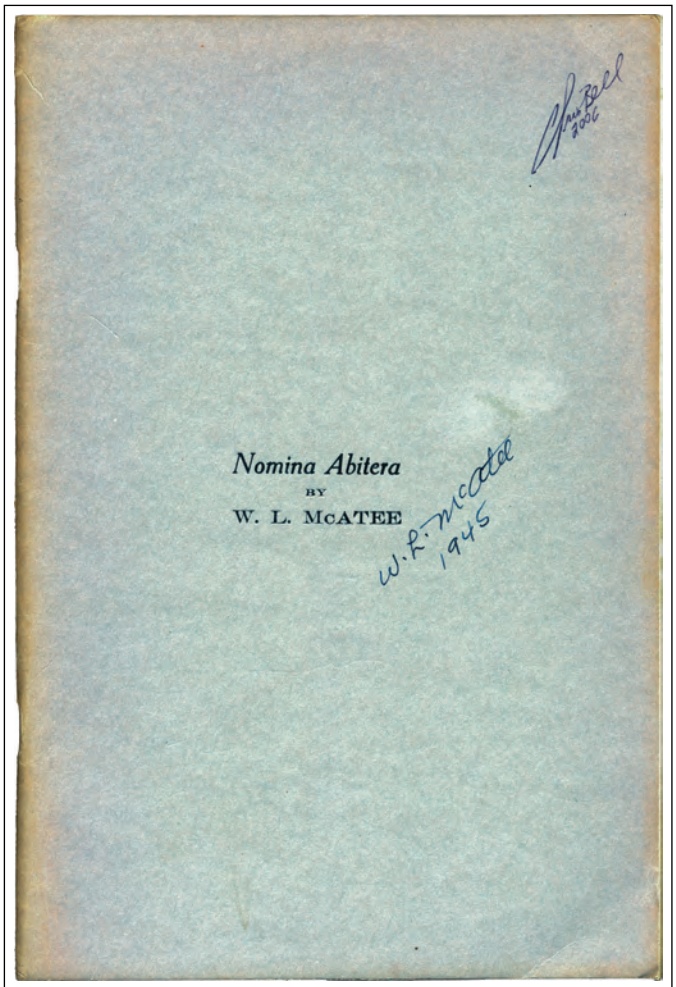


Fig. 2. Cover of *Nomina Abitera*. Privately published by Waldo McAtee in 1945.

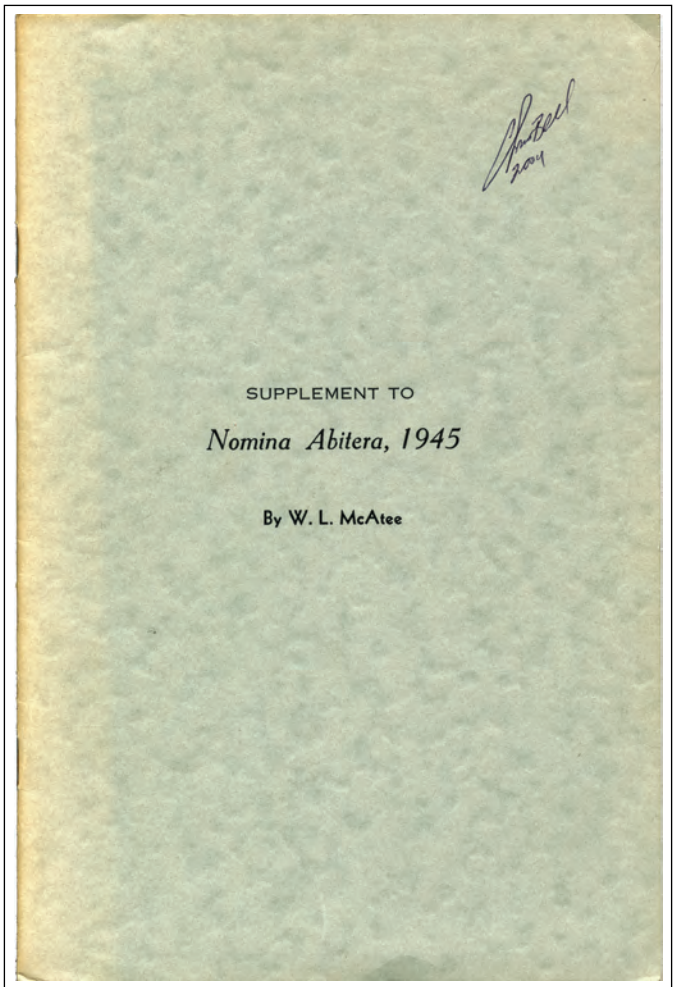


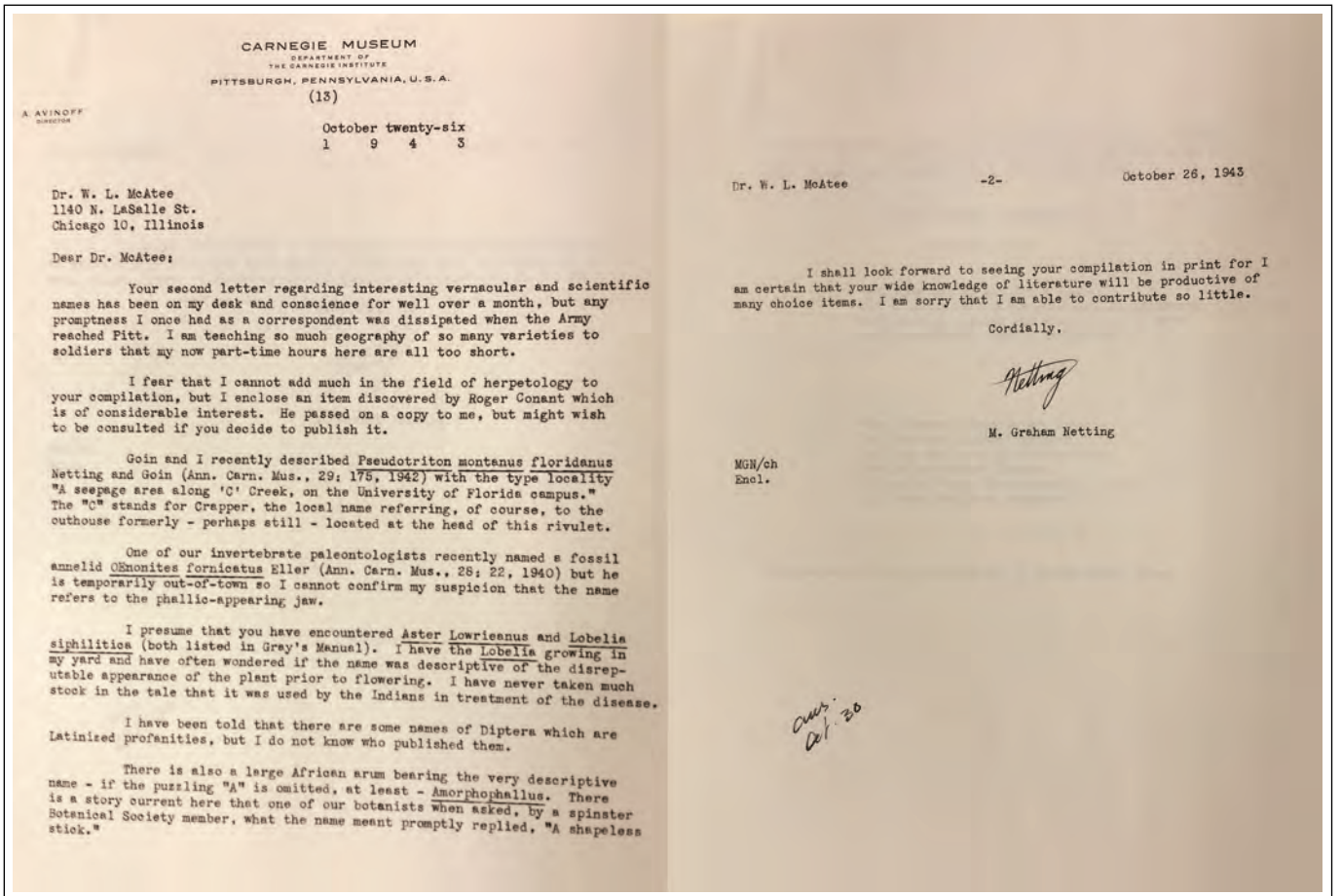
Fig. 3. Cover of *Supplement to Nomina Abitera, 1945*. Privately published by Waldo McAtee in 1954.

1907 (Kalmbach, 1968). In 1919 he made a public announcement in print that he intended to examine "practically the whole ornithological literature in America" in order to catalog the vernacular names for birds on the continent (McAtee, 1919:323). He published his intent to ensure that "the field was clear" (McAtee, 1919:323) before advancing on the two glossaries of "unusual bird names" (McAtee, 1919:324) he had already completed (McAtee, 1911; M'Atee 1917). As bold as the initial claim may have been, the ultimate result of that effort was the production three decades later of a massive work planned for publication in two volumes. Neither has yet seen print. Volume 1 of the work contains the main text and consists of 1,697 typed pages; the index (volume 2) encompasses 158,000 2" × 5" slips of paper and 4,100 bibliography cards in 90 file drawers. An estimated 500,000 names are involved in the index. Those figures, and a brief history of the project were provided by Kalmbach (1968).

Background to *Nomina Abitera* and *Supplement to Nomina Abitera, 1945*

Waldo McAtee's *Nomina Abitera* (1945, Fig. 2) and the *Supplement to Nomina Abitera, 1945* that appeared nearly a decade later (1954; Fig. 3) are obscure, privately printed compilations of the use of ribald and prurient terminology ('dirty words') in geographical and biological nomenclature. They rank high on my list of interesting and difficult-to-obtain publications that emerged in the long history of writings about zoological nomenclature. Both were born from McAtee's desire to thoroughly document vernacular nomenclature for birds, but his recognition that a particular category of names was recognizable across biological nomenclature led him to produce these two works that catalogued otherwise 'unprintable' designations.

McAtee compiled and wrote these two works in a different time and, although many of the terms he selected for their prurient or ribald relevance for the *Nomina* are as unacceptable today as they were in 1945 and 1954, some of the words he used in his general prose are also today considered socially or politically incorrect. All of his original words are reproduced below as originally published.



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DEPARTMENT OF THE CARNEGIE INSTITUTE
PITTSBURGH, PENNSYLVANIA, U.S.A.
(13)

A. AVINOFF
DIRECTOR

October twenty-six
1 9 4 3

Dr. W. L. McAtee
1140 N. LaSalle St.
Chicago 10, Illinois

Dear Dr. McAtee:

Your second letter regarding interesting vernacular and scientific names has been on my desk and conscience for well over a month, but any promptness I once had as a correspondent was dissipated when the Army reached Pitt. I am teaching so much geography of so many varieties to soldiers that my now part-time hours here are all too short.

I fear that I cannot add much in the field of herpetology to your compilation, but I enclose an item discovered by Roger Conant which is of considerable interest. He passed on a copy to me, but might wish to be consulted if you decide to publish it.

Goin and I recently described Pseudotriton montanus floridanus Netting and Goin (Ann. Carn. Mus., 29: 175, 1942) with the type locality "A seepage area along 'C' Creek, on the University of Florida campus." The "C" stands for Crapper, the local name referring, of course, to the outhouse formerly - perhaps still - located at the head of this rivulet.

One of our invertebrate paleontologists recently named a fossil annelid Oenonites fornicatus Eller (Ann. Carn. Mus., 28: 22, 1940) but he is temporarily out-of-town so I cannot confirm my suspicion that the name refers to the phallic-appearing jaw.

I presume that you have encountered Aster Lowrieanus and Lobelia siphilitica (both listed in Grey's Manual). I have the Lobelia growing in my yard and have often wondered if the name was descriptive of the disreputable appearance of the plant prior to flowering. I have never taken much stock in the tale that it was used by the Indians in treatment of the disease.

I have been told that there are some names of Diptera which are Latinized profanities, but I do not know who published them.

There is also a large African arum bearing the very descriptive name - if the puzzling "A" is omitted, at least - Amorphophallus. There is a story current here that one of our botanists when asked, by a spinster Botanical Society member, what the name meant promptly replied, "A shapeless stick."

Dr. W. L. McAtee -2- October 26, 1943

I shall look forward to seeing your compilation in print for I am certain that your wide knowledge of literature will be productive of many choice items. I am sorry that I am able to contribute so little.

Cordially,

Netting

M. Graham Netting

MGN/ch
Encl.

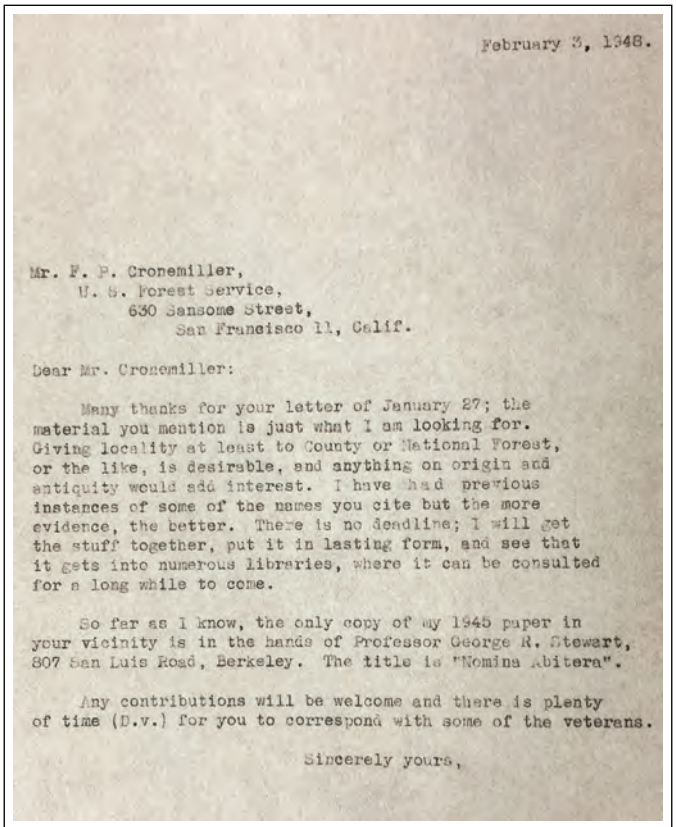
Oct. 30

Fig. 4. Letter from M. Graham Netting to Waldo McAtee, 26 October 1943. Netting's comment on the type locality of *Pseudotriton montanus floridana* was included in *Nomina Abitera*, but the preceding "item" from Roger Conant was not.

Nomina Abitera (1945)

Nomina Abitera is 50 pages long in octavo format and provides a short alphabetical listing of geographic place names, and from biological nomenclature brief listings of names for algae, fungi, fishes, frogs, and reptiles, and more expansive examples for seed plants, invertebrates (noted by McAtee to be "weaker than I had hoped for"), birds, and mammals. McAtee made clear that for the geography section, it was not his purpose to provide an exhaustive list of the use of ribald nomenclature, but rather to provide just enough to support a general "thesis of relish for the vulgar" (McAtee, 1945:1). The less than two pages of geographic content bear out that claim, but do include an interesting comment from herpetologist M. Graham Netting who made a contribution pertaining to the type locality of *Pseudotriton montanus floridanus* on the campus of the University of Florida in Gainesville (Fig. 4, third paragraph; Netting also enclosed with his letter some potential content "of considerable interest" that he received from Roger Conant—see second paragraph of letter in Fig. 4; whatever it was, it was not included in *Nomina Abitera* and I did not find it among the papers in the Library of Congress). In contrast to the section on geography, ten pages are dedicated to nomenclature of 'plants'(including brief entries for algae and fungi), two to invertebrates, a bit more than one each to fishes and herpetological taxa, 25 to birds, and four to mammals. A fictionalized "Abstract of Proceedings" of the "Young Botanists' Research Club" (McAtee, 1945:16–18) is appended to the section on seed plants and served as an outlet for McAtee to explore various species epithets applied to the plant genera *Pinus*, *Clitoria*, and *Orchis*.

The first two of McAtee's glossaries of bird names (cited above), and his subsequent works in the same vein, are nearly devoid of the nomenclatural 'oddities' upon which he focused so attentively in *Nomina Abitera* and the *Supplement* (although 'shite-poke' [='shit-bag'—see McAtee, 1945:25] passed under the editor's pen and made it into print; see M'Atee, 1917:78). Clearly those omissions reflect restrictions *placed upon* McAtee by publishers of his 'mainstream' works, and not a disinterest *on his part* in their inclusion. In the mid-1950s McAtee noted that "existing, though by me unapproved, handicaps upon distribution of esoteric material" (McAtee, 1954b) led to separate compilations and private publication of the ribald, prurient, and 'dirty' words (many of which had been bowdlerized through creative use of abbreviation or truncation) that McAtee uncovered in his research. *Nomina Abitera* and *Supplement to Nomina Abitera, 1945* are the result of his efforts to uncover and elucidate these names.



February 3, 1948.

Mr. F. P. Cronemiller,
U. S. Forest Service,
630 Sansome Street,
San Francisco 11, Calif.

Dear Mr. Cronemiller:

Many thanks for your letter of January 27; the material you mention is just what I am looking for. Giving locality at least to County or National Forest, or the like, is desirable, and anything on origin and antiquity would add interest. I have had previous instances of some of the names you cite but the more evidence, the better. There is no deadline; I will get the stuff together, put it in lasting form, and see that it gets into numerous libraries, where it can be consulted for a long while to come.

So far as I know, the only copy of my 1945 paper in your vicinity is in the hands of Professor George R. Stewart, 807 San Luis Road, Berkeley. The title is "Nomina Abitera".

Any contributions will be welcome and there is plenty of time (D.v.) for you to correspond with some of the veterans.

Sincerely yours,

Fig. 5. Letter to F. P. Cronemiller from Waldo McAtee, 3 February 1948, soliciting contributions for *Supplement to Nomina Abitera, 1945*. Solicitations were of the same general format, but were individualized for each recipient. George R. Stewart is identified as a recipient of *Nomina Abitera*.

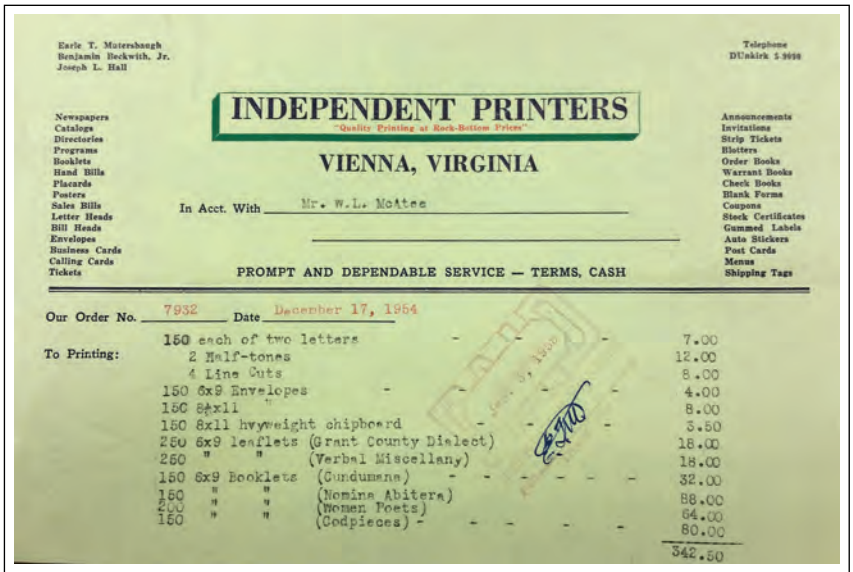
Fig. 6. Four of the six privately published documents mailed by McAtee late in 1954. These accompanied the *Supplement to Nomina Abitera, 1945*. Not shown is a sixth document on "Women Poets" (see text, and Fig. 7).

McAtee specifically eschewed use of the word 'indecency' in describing the content of those works and noted it has been well said by a great apostle of intellectual freedom—Theodore Shroeder—that, 'Obscenity is always and exclusively in the psychology of the accusing person'" (McAtee, 1945:1).

Upon the completion of the original summary in 1945, McAtee certainly would have faced the challenge of identifying a formal publisher among those specializing in production of works in mainstream science or literature. He was, however, already comfortable with the notion and practice of private publication and circulation of his thoughts, compilations, and writings that addressed many topics well outside of mainstream academia. The earliest of his privately published works in my library is from 1935 (McAtee, 1935b; see above). The *Nomina Abitera* and at least one other work (*Art Hell- Or Heaven-ward Bound?*) were privately published in 1945 and by the 1950s small collections of these writings were printed and distributed to a relatively small circle of friends and colleagues at or near the end of the year, often expressly as holiday greetings (Kalmbach, 1963; e.g., *A Little on Cussing*, September, 1955; *The Meaning of Life*, December, 1957 with a "compliments of the season" annotation and an appended note "Jan. 21, 1958 will be my 75th anniversary, if I make it."—he did, lasting to just short of his 79th birthday).

Supplement to Nomina Abitera, 1945 (1954)

Following the publication of *Nomina Abitera*, McAtee continued to gather and receive additional content of sufficient quantity to justify a supplement. By early 1948 he was actively soliciting additional content (Fig. 5) and *Supplement to Nomina Abitera, 1945* was published in 1954 in octavo format. It follows the same general format and organization as the 1945 work, but its 11 pages were un-numbered. It was included as one of (seemingly) six privately published titles circulated that year. Those included *Verbal Miscellany* (McAtee, 1954c), *On Codpieces* (McAtee, 1954d), *Cundumana* (McAtee, 1954e, a history of the condom as a prophylactic and contraceptive), and S*upplement 4 on Grant County, Indiana, Dialect* (McAtee, 1954f) (Fig. 6). Those five came into my possession as a set enclosed in a mailing envelope with a penciled label 'WLM 1954' on the outside. A sixth title is listed as *Women Poets* on the invoice for printing costs for the 1954 collection (Fig. 7); WorldCat records suggest a full title was *What Women Poets Think About It* (the Library of Congress description is "selections from women's bawdy or erotic poetry" — OCLC 1006521237). The invoice is pre-



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In Acct. With Mr. W.L. McAtee

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Our Order No. 7932 Date December 17, 1954

To Printing:

150	each of two letters	7.00
2	Half-tones	12.00
4	Line Cuts	8.00
150	6x9 Envelopes	4.00
150	8x11 "	8.00
150	8x11 hvyweight chipboard	3.50
250	6x9 leaflets (Grant County Dialect)	18.00
250	" " (Verbal Miscellany)	18.00
150	6x9 Booklets (Gundumana)	32.00
150	" " (Nomina Abitera)	88.00
150	" " (Women Poets)	64.00
150	" " (Codpieces)	80.00
		342.50

Fig. 7. Printing invoice for the privately published documents in 1954. This shows that only 150 copies of the *Supplement to Nomina Abitera*, *1945* were printed. McAtee was retired and living in Chapel Hill, N.C. at this time.

served in the papers pertaining to the *Nomina Abitera* in the Library of Congress in Washington, D.C. It indicates a print run of only 150 copies for the *Supplement* (Fig. 7).

Both the *Nomina Abitera* and the *Supplement* were privately published with no location provided for place of production or printing. All of the privately printed writings from 1954 also were issued without an indicated location of printing/publishing. Only the *Note on accompanying leaflets* (McAtee, 1954b) indicated McAtee's address in Chapel Hill, North Carolina. The invoice indicates that the collection was printed by Independent Printers in Vienna, Virginia (Fig. 7).

Government regulations pertaining to conservation of paper and other essential materials during World War II impacted the printing of the *Nomina Abitera* (but not the *Supplement*) in a subtle way. In a miniscule font at the end of the work (Fig. 8), McAtee noted that wartime conditions prevented the printer from replacing a type-font that would have allowed italics to be used in the text for scientific names. He also noted the lack of diacritics throughout the text for the same reason and closed with the comment "I hope for broad-minded readers who will overlook these defects" (McAtee, 1945:50).

Surviving Copies

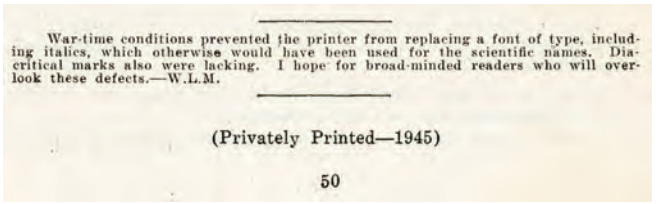
Enclosed in the mailing envelope containing the 1954 writings was a single printed sheet titled *Note on Accompanying Leaflets* (McAtee, 1954b; Fig. 9) that sheds light on the history of both the 1945 and 1954 compilations. The *Note* admonishes recipients not to be "inspired to request copies of earlier articles, as all were in strictly limited editions, which were soon exhausted" (earlier, McAtee [1951:243] published a note that his privately published works on dialect issued between 1942 and 1946 were in editions of only 100 copies — the same print run may well have applied to *Nomina Abitera*). The *Note* also indicates that most copies of *Nomina Abitera* were distributed to individuals but that 14 copies were sent to "leading libraries, where it is hoped they have been preserved and may be consulted." Of the 14 libraries listed, WorldCat records confirm that 12 of them still hold the title. The exceptions are Johns Hopkins University and University of Michigan in Ann Arbor. Neither currently has a copy in their collection (Amy Kimball, pers. comm., April, 2023; Bond, pers. comm., April, 2023). Additional copies are held by the British Library, University of Texas at El Paso, Arizona Historical Society, Utah State University, University of Toronto Gerstein Science Information Center, and the University of Toronto Group. The Library of Congress houses at least two copies. In correspondence that is included with the papers associated with production of *Nomina Abitera* in the Library of Congress, I found mention of two of the private recipients, George R. Stewart (mentioned in letter dated 3 February 1948 from McAtee to F. P. Cronemiller; Fig. 5) and John Terres (thanked McAtee for a copy in a letter dated 1 February 1948; Fig. 10), and possibly two others — Hartley H. T. Jackson specifically requested a copy (letter to McAtee dated 19 February, 1943), as did Pierce Brodkorb (but after the publication was released, letter to McAtee, dated 12 October, 1946). Brodkorb referred specifically to *Nomina Abitera* in his letter, and may well have been a recipient. With the one I have in hand (purchased from an online book dealer in 2006) that accounts for 21 copies, and possibly two others.

The *Supplement* may have suffered a lower incidence of survival. Of the 150 printed copies indicated on the 1954 invoice (Fig. 7), I have one copy, at least two copies are in the Library of Congress, and other copies are listed in WorldCat at the New York Public Library, Yale University, University of Chicago, University of Michigan, University of Rochester, and University of Virginia. Thus, I can account for a total of only nine copies.

Herpetology in Nomina Abitera and the Supplement to Nomina Abitera, 1945

The herpetological portions of the *Nomina Abitera* and the *Supplement* are brief, and are reproduced here in their entirety. In total, two caecilian, one frog, five turtle, and three lizard species are indicated by name, and a general reference to emydid turtles ('cooters') was provided. The relative paucity of herpetological material likely is a result of McAtee's academic interests and focal areas in the decades preceding the publication of *Nomina Abitera*.

The herpetological content he included was derived from McAtee's correspondence with others (e.g., Figs. 11, 12) and



War-time conditions prevented the printer from replacing a font of type, including italics, which otherwise would have been used for the scientific names. Diacritical marks also were lacking. I hope for broad-minded readers who will overlook these defects.—W.L.M.

(Privately Printed—1945)

50

Fig. 8. Note in small font at the end of the last page of *Nomina Abitera* explaining that war-time conditions (World War II) resulted in sacrifices to details in the printing of the publication.

from the literature, from which McAtee recorded notes on strips of paper (e.g., Figs.13, 14, 15).

In the text reproduced below, I maintained the original format of bold font for taxon names, as used in the original text (McAtee's first use of 'Pseudemys' was not in bold font). McAtee did not provide a Literature Cited section for either publication, opting instead for the relative convenience and saved space (and costs) of abbreviated in-text citations. To facilitate access to the works he used, I provide complete citations to the works cited in the herpetological sections of *Nomina Abitera* and the *Supplement*. In a few cases I provide brief annotations as footnotes.

Herpetology in *Nomina Abitera* (1945, pp. 21–22)

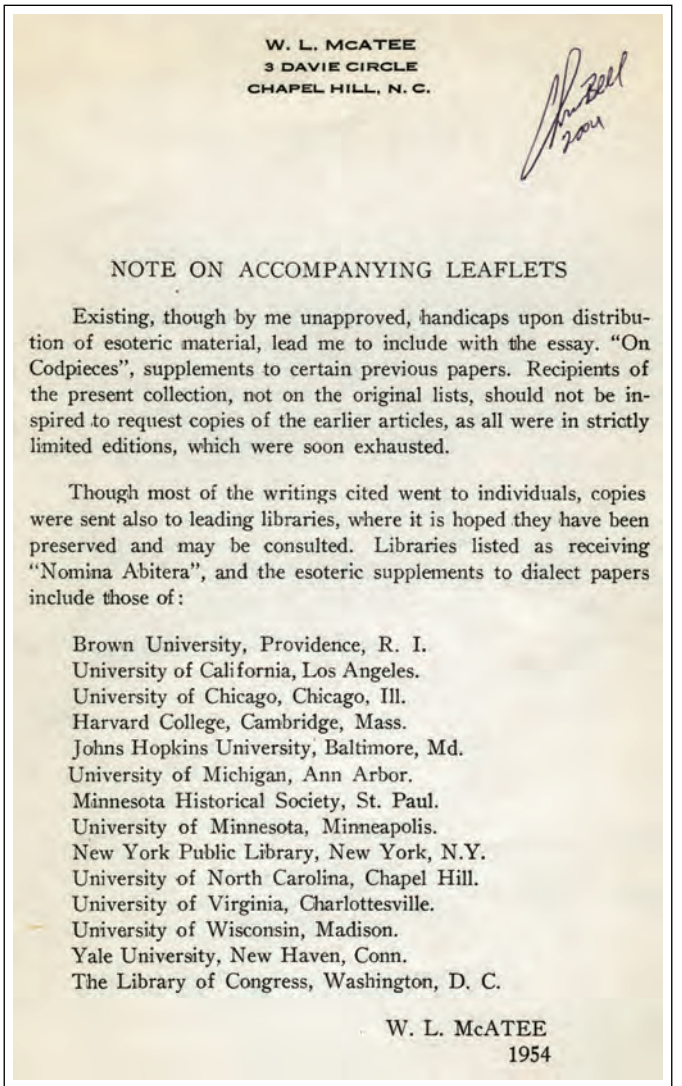
FROGS

Pickerel Frog (**Rana palustris**)—Although frogs in general and even toads may eject urine in a noticeable jet when suddenly flushed, the name "Pisser" was more or less fixed on this species in Grant County, Indiana, possibly because of its orange thighs and underparts, suggesting staining and also because of its unpleasant odor.

REPTILES

Loggerhead Turtle (**Caretta caretta**)—Samuel Clarke (A true and faithful account of the four chiefest Plantations of the English in America, etc., 1670, p. 21), writing of loggerhead turtles in the Bermudas, says: "Shortly after their coming to these islands, the male and female couple, which they call cooting, this they continue about three days together, during which time they will scarce separate though a boat come to them, nor hardly when they are smitten." This may be toned down from H. Stubbe's account in the Philosophical Transactions (Royal Society of London, 2, 1667, p. 500) which asserts that the "The Tortoises . . . coot for fourteen daies together."

These references do not involve unconventional names for this turtle, although nothing would be more natural than to call cooters those who coot, but they may have a bearing on that term as applied to various turtles in the southeastern United States. See below.



W. L. McATEE
3 DAVIE CIRCLE
CHAPEL HILL, N. C.

NOTE ON ACCOMPANYING LEAFLETS

Existing, though by me unapproved, handicaps upon distribution of esoteric material, lead me to include with the essay. "On Codpieces", supplements to certain previous papers. Recipients of the present collection, not on the original lists, should not be inspired to request copies of the earlier articles, as all were in strictly limited editions, which were soon exhausted.

Though most of the writings cited went to individuals, copies were sent also to leading libraries, where it is hoped they have been preserved and may be consulted. Libraries listed as receiving "Nomina Abitera", and the esoteric supplements to dialect papers include those of:

Brown University, Providence, R. I.
University of California, Los Angeles.
University of Chicago, Chicago, Ill.
Harvard College, Cambridge, Mass.
Johns Hopkins University, Baltimore, Md.
University of Michigan, Ann Arbor.
Minnesota Historical Society, St. Paul.
University of Minnesota, Minneapolis.
New York Public Library, New York, N.Y.
University of North Carolina, Chapel Hill.
University of Virginia, Charlottesville.
University of Wisconsin, Madison.
Yale University, New Haven, Conn.
The Library of Congress, Washington, D. C.

W. L. McATEE
1954

Fig. 9. Note from Waldo McAtee that was sent with the privately published documents in 1954. This indicates that most copies of the 1945 *Nomina Abitera* were sent to private individuals, but that at least 14 were sent to Libraries. 12 of the listed libraries still have the title in their collections – Johns Hopkins University and University of Michigan do not. The Library of Congress has two copies.

Snapping Turtle (**Chelydra serpentina**)—Kawan or tortue kawan, the latter term signifying female genitalia (E. O. Becker, Dialect Notes, 4 (6), 1917, p. 421).

Musk Turtle (**Sternotherus odoratus**)—Stinkpot is applied over the greater part of eastern North America; the odor of large specimens is exceedingly rank (John K. Strecker, Contrib. Baylor Univ. Mus., 16, 1928, p. 20). Allied terms include: stinking turtle, stinky pot, stinky turtle, stinky pond turtle (Henry W. Fowler, Ann. Rep., New Jersey State Museum, 1906 (1907), p. 223), and stinkin' jim, East Alabama (L. W. Payne, Jr., Dialect Notes 3 (5), 1909, p. 376).

Pond Turtles (**Emydidae**)—"Among the negroes of the Gullah district of South Carolina, a cooter is any kind of hard-shelled turtle. The name has spread all over the South, but at present time principally refers to large river and pond turtles of the genus Pseudemys" (John K. Strecker, op. cit., p. 6). G. Browne Goode (Fisheries of the U. S., 1884) has recorded this name for the box turtle (**Terrapene carolina**) (p. 158) and "Florida cooter" for **Pseudemys concinna** (p. 155). Reed Smith (Gullah, Bul. 190, Univ. of South Carolina, 1926, p. 32) treats the term as a surviving native African word, spelling it "cootuh," which after all is only the way almost anyone in the South would pronounce "cooter." The matter presented under loggerhead (ante) would seem to throw considerable doubt on Smith's theory.

I have heard the name in various Southeastern localities, but without explanation. It may well trace to the cooting of early Bermudian usage. The terrapins so commonly seen on snags or other supports near the waters lie in copula for hours together and the box tortoises draw attention to their copulation by the knocking together of their hard shells.

Collared Lizard (**Crotaphytus collaris**)—Gray bitch, Panhandle of Texas; glade devil, Missouri and Arkansas (John K. Strecker, op. cit., p. 11).

Iguana (**Basiliscus americanus**)—Lagarto Jesucristo, Central America (because of its ability to move over water; press account [1]).

Iguana (**Basiliscus vittatus**)—Cockman, British Honduras (its appearance in display suggests a human erection, Karl P. Schmidt[2]).

From Supplement to *Nomina Abitera, 1945* (1954, [p. 6])

Amphibians

Worm salamanders (*Caeciliidae*)—Pierce Brodkorb put me on to the trail of the following information and Norman Hartweg has supplied it. The name tapaculo (hide your ass), given to birds cocking their tails like wrens was noticed in N. A., 1945 (p. 41)[3] can have another meaning of plug-ass. Now read Doctor Hartweg: There are two species of caecilians in southeastern Chiapas: *Gymnophis mexicanus*[4] and *Gymnophis multiplicatus*. The natives do not distinguish between them, both being known as *tapaculo* or, infrequently, *tapalcu*. The superstition held by these southern Indians is that the animal enters through the anus and eventually causes death by blocking the exit so that bowel movement is impossible. I was told to scrape away surface litter and to examine the ground closely for lurking tapaculos before evacuation . . . And, of course, all human endoparasites are the young of the tapaculo.

Literature Citations in the Herpetological Portions of *Nomina Abitera* and the *Supplement*

Becker, E. O. 1917. Terms from Louisiana. Terms from New Orleans. (2) Collected by E. O. Becker. Dialect Notes 4(6):421. [This is a series of collections by at least three authors, running from pages 420 to 431; the Table of Contents identifies only James Routh as the author. Routh's is the first collection of terms listed, Becker's is the second, the third list is unattributed (anonymous), and the fourth is a collection of terms from notes by Stanley Clisby Archer that were published in *The Times Picayune*].

Clarke, S. 1670. A True, and Faithful Account of the Four Chiefest Plantations of the Engliſh in America. To Wit, of Virginia. New-England. Bermudus. Barbados. With the Temperature of the Air: The Nature of the Soil: The Rivers, Mountains, Beaſts, Fowls, Birds, Fiſhes, Trees, Plants, Fruits &c. As Also, of the Natives of Virginia, and New-England, their Religion, Cuſtoms, Fiſhing, Huntings, &c. Printed for Robert Clavel, Thomas Paſſenger, William Cadman, William Whitwood, Thomas Sawbridge, and William Birch, London, United Kingdom. [90 pp.].

Darwin, C., ed. 1841. The Zoology of the Voyage of H. M. S. Beagle, Under the Command of Captain Fitzroy, R. N., During the Years 1832 to 1836. Part III. Birds. Birds, Described by John Gould, Esq. F. L.S. with A Notice of Their Habits and Ranges by Charles Darwin, Esq. M.A. F.R.S. Sec. Geolog. Soc. and With an Anatomical Appendix, by T. C. Eyton, Esq. F.R.S. Smith, Elder and Co., London, United Kingdom. [6] + 156 + [8] pp., 50 plates.

Fowler, H. W. 1907. The Amphibians and Reptiles of New Jersey. Pp. 23–250, Plates 1–69 *in* 1906 Annual Report of the New Jersey

[1] See Figure 16 for an image of McAtee's press source. There is no indication of the publisher, but the clipping is preserved in the Library of Congress.

[2] I am not sure how Schmidt communicated this information to McAtee, but there is a note in McAtee's handwriting in the Library of Congress that attributes this record to K. P. Schmidt (Figure 17). The common name is consistent with others from Belize (British Honduras), given by Neill and Allen (1959:38) as cock lizard, cock McLellan, and cock maklala.

[3] The original text from *Nomina Abitera* (1945:41) is given here. "Tapaculo (**Scelorchilus albicollis**)—Charles Darwin wrote of this bird of Chili and western Argentina: "This species is called by the Chilenos, 'Tapacola,' or 'cover your posteriors." The name is well applied, as the tapacola generally carries its short tail more than erect, that is inclined backward [he should have said forward] and toward the head." (Voyage of the Beagle, Zoology, 3, 1838–41, p. 72). The word generally written "tapaculo," may be translated more bluntly than by Darwin as "hide your ass," and is I am told by E. G. Holt and A. Wetmore, applied to the smaller species of Pteroptochidae in general." [CJB Note: The name was actually spelled 'Tapacolo' by Darwin in both uses in the quoted section above].

[4] *Dermophis mexicanus*; the name was properly given in Hartweg's letter (Figure 11) but was conflated by McAtee with *Gymnophis*.

State Museum, Including a List of the Specimens Received During the Year, Financial Report, with a Report of the Amphibians and Reptiles of New Jersey and a Supplement to the "Fishes of New Jersey." New Jersey State Museum [Printed by MacCrellish & Quigley, State Printers, Trenton, New Jersey].

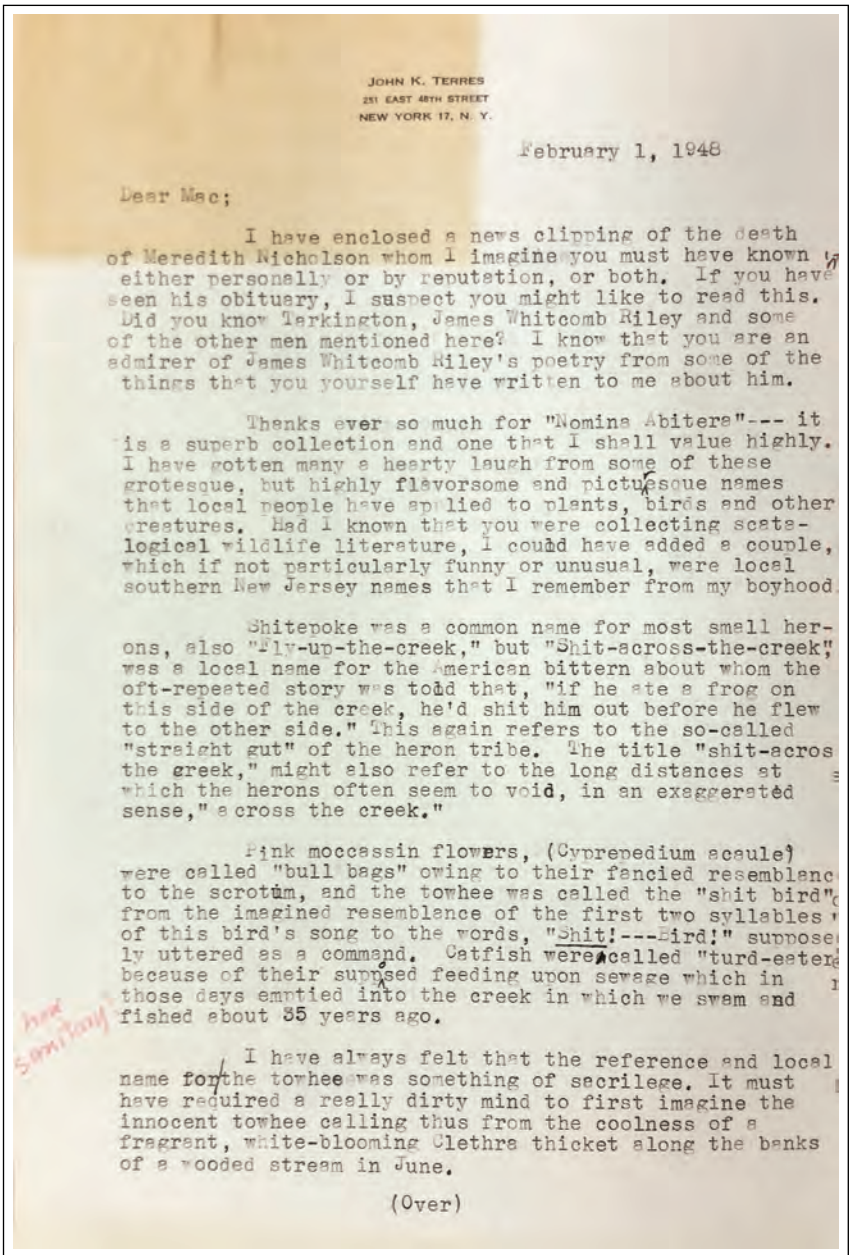
Goode, G. B. 1884. The Fisheries and Fishery Industries of the United States. Section I. Natural History of Useful Aquatic Animals. Text. United States Commission of Fish and Fisheries. Government Printing Office, Washington, D. C. xxxiv + 895 pp.

Payne, L. W., Jr. 1909. A word-list from east Alabama [Continued from Part IV, 1908, p. 328]. Dialect Notes 3(5):343–391.

Smith, R. 1926. Gullah. Bulletin of the University of South Carolina 190. 45 pp.

Strecker, J. K. 1928. Common English and folk names for Texas amphibians and reptiles. Contributions from Baylor University Museum 16:1–21.

[Stubbe, H.]. 1667. Obſervations made by a curious and learned perſon, ſailing from England, to the Caribe Iſlands. Philosophical Transactions [Royal Society of London], 2(27):494–502. [Author not identified in the original, but is identified by the Royal Society in the online version; Biodiversity Heritage Library version is paginated [493–502], but the Royal Society online version is paginated 494–502].



JOHN K. TERRES
251 EAST 48TH STREET
NEW YORK 17, N. Y.

February 1, 1948

Dear Mac;

I have enclosed a news clipping of the death of Meredith Nicholson whom I imagine you must have known either personally or by reputation, or both. If you have seen his obituary, I suspect you might like to read this. Did you know Tarkington, James Whitcomb Riley and some of the other men mentioned here? I know that you are an admirer of James Whitcomb Riley's poetry from some of the things that you yourself have written to me about him.

Thanks ever so much for "Nomina Abitera"--- it is a superb collection and one that I shall value highly. I have gotten many a hearty laugh from some of these grotesque, but highly flavorsome and picturesque names that local people have applied to plants, birds and other creatures. Had I known that you were collecting scatalogical wildlife literature, I could have added a couple, which if not particularly funny or unusual, were local southern New Jersey names that I remember from my boyhood.

Shitepoke was a common name for most small herons, also "Fly-up-the-creek," but "Shit-across-the-creek" was a local name for the American bittern about whom the oft-repeated story was told that, "if he ate a frog on this side of the creek, he'd shit him out before he flew to the other side." This again refers to the so-called "straight gut" of the heron tribe. The title "shit-across the creek," might also refer to the long distances at which the herons often seem to void, in an exaggerated sense," across the creek."

Pink moccassin flowers, (Cypripedium acaule) were called "bull bags" owing to their fancied resemblance to the scrotum, and the towhee was called the "shit bird" from the imagined resemblance of the first two syllables of this bird's song to the words, "Shit!---Bird!" supposedly uttered as a command. Catfish were called "turd-eaters" because of their supposed feeding upon sewage which in those days emptied into the creek in which we swam and fished about 35 years ago.

I have always felt that the reference and local name for the towhee was something of sacrilege. It must have required a really dirty mind to first imagine the innocent towhee calling thus from the coolness of a fragrant, white-blooming Clethra thicket along the banks of a wooded stream in June.

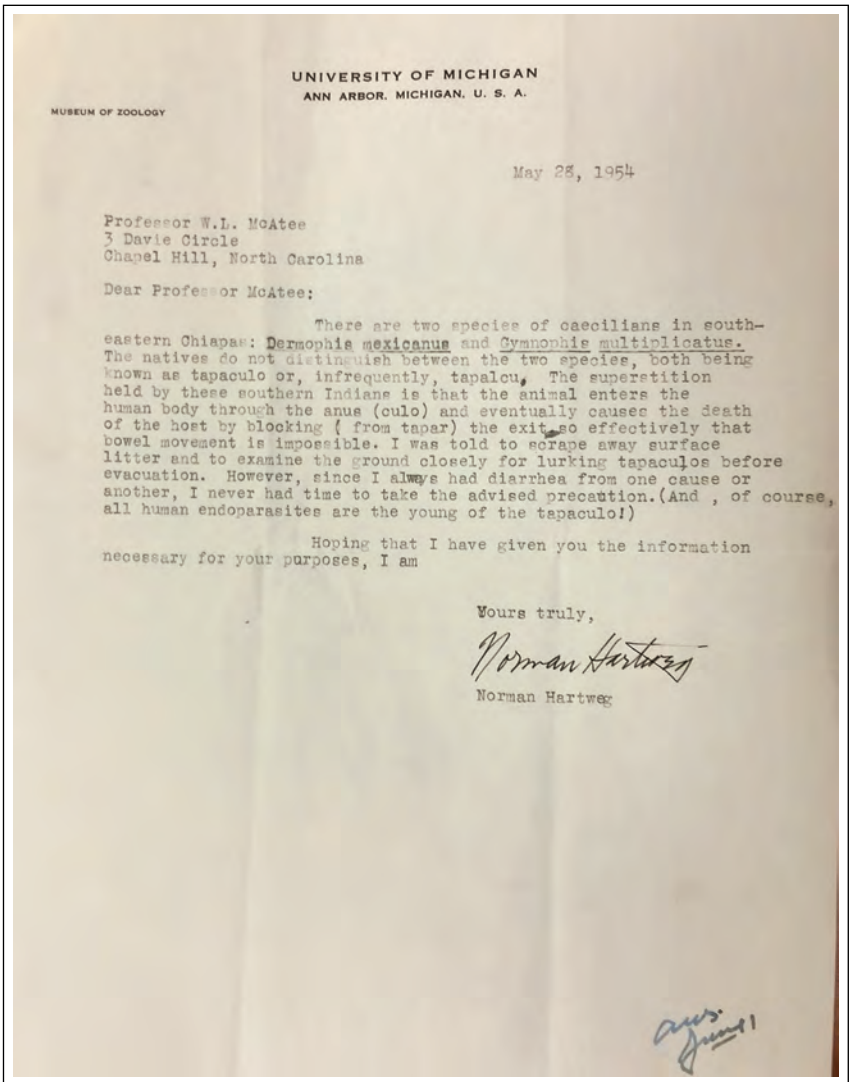
(Over)

Fig. 10. Letter from John Terres to Waldo McAtee dated 1 February 1948, acknowledging receipt of a copy of *Nomina Abitera*.

Reflections and Conclusions

McAtee's works were released only as privately published booklets, as opposed to mass-produced volumes printed and distributed by a mainstream publisher. Perhaps that is just the way McAtee wished it to be, or perhaps he was unwilling to make the effort to fight for a more mainstream release? I don't know, but suppression of McAtee's compilations would be almost a foregone conclusion in some places within the United States today, as indeed it would have been at the times of their release.

I write these words on the 90th anniversary of the rise of the Nazi book-burnings in May 1933, an infamous event in the history of censorship. Simultaneously, my modern news feeds are filled with reports of book banning, successful and unsuccessful attempts to restrict access to books, and the castigation of professional librarians trying to meet the needs of diverse audiences. The publication of *Nomina Abitera* and the *Supplement* are bracketed by those events, and re-reading them during the preparation of this paper forced me to reflect upon the meeting in those pages of two human tendencies. As my epigraphic selections attest, McAtee was well aware of the "innate tendency" in humans towards ribaldry. His long history of privately publishing his works on 'esoterica' suggests an equal familiarity with the tendency towards censorship. Balancing these may be tricky under various circumstances, but for the lexical scholar, the role McAtee assumed as compiler of *Nomina Abitera* and the *Supplement*, the problem really is acute. Instead of suppressing or avoiding prurient, ribald, or obscene terminology, McAtee embraced it, faithfully documented it, and had fun with it. In the second paragraph of *Nomina Abitera*, McAtee (1945:1) noted "I do not use the term 'indecency,' because that qual-



UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN, U. S. A.
MUSEUM OF ZOOLOGY

May 28, 1954

Professor W.L. McAtee
3 Davie Circle
Chapel Hill, North Carolina

Dear Professor McAtee:

There are two species of caecilians in southeastern Chiapas: Dermophis mexicanus and Gymnophis multiplicatus. The natives do not distinguish between the two species, both being known as tapaculo or, infrequently, tapalcu. The superstition held by these southern Indians is that the animal enters the human body through the anus (culo) and eventually causes the death of the host by blocking (from tapar) the exit so effectively that bowel movement is impossible. I was told to scrape away surface litter and to examine the ground closely for lurking tapaculos before evacuation. However, since I always had diarrhea from one cause or another, I never had time to take the advised precaution.(And , of course, all human endoparasites are the young of the tapaculo!)

Hoping that I have given you the information necessary for your purposes, I am

Yours truly,

Norman Hartweg

Norman Hartweg

Fig. 11. Letter from Norman Hartweg to Waldo McAtee on 28 May 1954 describing a local superstition (Chiapas, México) about caecilians. Most of these data were included in *Supplement to Nomina Abitera, 1945*, but McAtee used the name *Gymnophis* for both species, and omitted the reference to persistent diarrhea.

ity characterizes, not challenged bits of natural grossness, but rather the minds of finicky auditors or observers" … he was obviously aware of those who are determined to be offended and to seek out excuses to express their opprobrium. He went on to note that ribaldry "is only a sign of the robust heartiness that is an important part of the make-up of every well-endowed human being, and of an abiding sense of humor that has helped pioneers, explorers, soldiers, in fact almost all doers through many a struggle with the difficulties of life" (McAtee, 1945:1). McAtee closed the *Supplement* (McAtee, 1954:[11]) with the words:

> "I have written many scientific papers, in some of which progress was made toward the scientist's goal: extension of the bounds of knowledge. But I take as much saitisfaction in such undertakings as Nomina Abitera (1945) and the present supplement because they are part of the battle that must always be waged against obscurantists, who would restrict the domain of language, and hypocrites who pretend that certain classes of words do not exist. My maximum uncompliments to cartographers who bowdlerize, and to lexicographers who ignore, some of the most interesting parts of the language of the people."

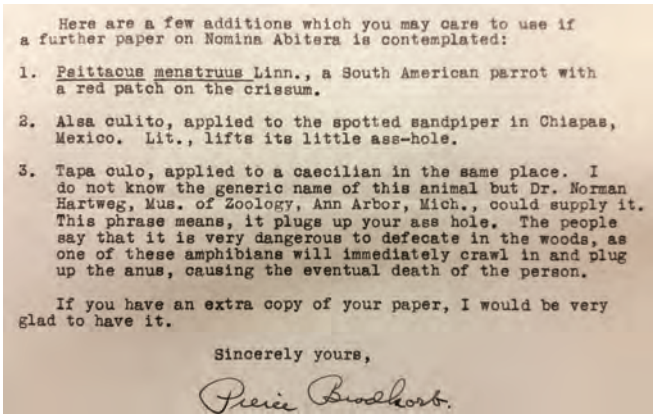
Moreover, most people are already cognizant not only of the existence of the various words in the *Nomina Abitera*, but also of their meaning. I qualify that by noting that McAtee certainly had a talent for ferreting out subtleties that might be lost on others, including terminology sitting right before our eyes that needs but a tweak in perception or perspective to unveil new meaning (e.g., *Pinus*; see below). This point was addressed directly by Charles Lovell in a letter sent to McAtee soon after publication of the *Nomina Abitera*.

> "If cunnus was good enough for Ovid, why blush at 'cunt'? The fact that it is known to every person, is proof that it belongs to our language, for how else could it have survived through the centuries? Any lexicographer that takes it upon himself to be a censor of morals is not intellectually honest; it is his duty to record the words of every day language, whatever he may think of them personally."[5]

Those considerations aside, there is another intriguing aspect to these publications — their relative obscurity. I obtained a copy of the *Supplement* before I knew of the existence of *Nomina Abitera*. The difficulty I had in obtaining the original work prompted my curiosity about how well known it was. My motivation to write this historical review was derived from the fact that although I have asked many people about *Nomina Abitera* and the *Supplement*, including people who are keenly interested in biological nomenclature and its history, only one (Carl Gans) had even heard of it. Despite their relative obscurity and the distinct difficulty in obtaining original copies of the two works, in my opinion, both make for interesting, entertaining, and educational reading.

It is interesting that McAtee made the compilations in the first place… and that he published them in the way he did… and that most of the libraries to which he sent them actually did retain and conserve their copies to the present day and hopefully will do so well into the future. I note, however, that none of the holding libraries are marked in WorldCat as 'committed to retain'—a (relatively) newly emergent re-

[5] Letter from Charles H. Lovell to Waldo L. McAtee, 23 January, 1947. Library of Congress, Correspondence and Notes Related to *Nomina Abitera*.



Here are a few additions which you may care to use if a further paper on Nomina Abitera is contemplated:

1. Psittacus menstruus Linn., a South American parrot with a red patch on the crissum.

2. Alsa culito, applied to the spotted sandpiper in Chiapas, Mexico. Lit., lifts its little ass-hole.

3. Tapa culo, applied to a caecilian in the same place. I do not know the generic name of this animal but Dr. Norman Hartweg, Mus. of Zoology, Ann Arbor, Mich., could supply it. This phrase means, it plugs up your ass hole. The people say that it is very dangerous to defecate in the woods, as one of these amphibians will immediately crawl in and plug up the anus, causing the eventual death of the person.

If you have an extra copy of your paper, I would be very glad to have it.

Sincerely yours,

Pierce Brodkorb.

Fig. 12. Close-up of a letter from Pierce Brodkorb to Waldo McAtee, dated 12 October 1946. McAtee followed Brodkorb's suggestion to contact Norman Hartweg to obtain more details.

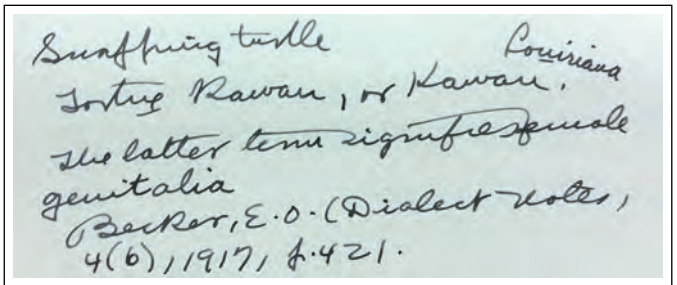


Fig. 13. A note in McAtee's handwriting pertaining to a reference (Becker, 1917) about common names for snapping turtles in Louisiana. The archives for the *Nomina Abitera* project are filled with many such notes on ~3x5-inch slips of paper.

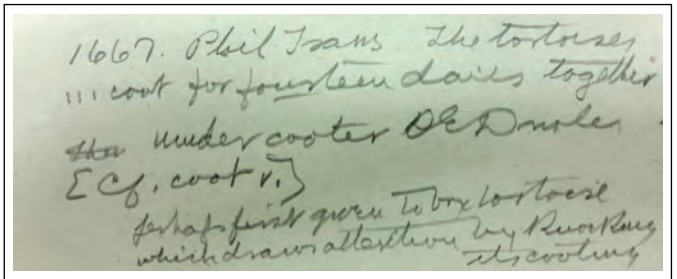


Fig. 14. A 3x5-inch slip in McAtee's hand, with notes on a 1667 reference to cooters.

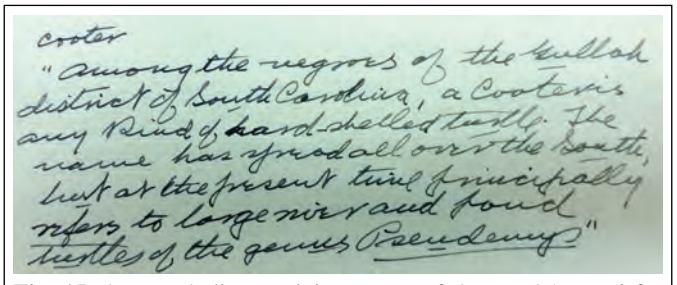


Fig. 15. A second slip pertaining to use of the word 'cooter' for turtles in the genus *Pseudemys*.

minder from 'the world's most comprehensive database of information about library collections' that many modern libraries are actively disposing of their print content.

I found the two booklets entertaining because of McAtee's sense of humor and the fact that his work inspired me to think of things in new ways. I had, for example, never before given any thought the generic name of the pine trees (*Pinus*) that surrounded me in my youth and still do today in much of my outdoor activities as an adult. Nor did I ever hear or consider any pronunciation of that name other than that with a long 'i.' Perhaps I was overly sheltered as a child and, therefore, emerged overly naïve as an adult. McAtee's erection of the fabricated 'program' for a meeting of the fictitious Young Botanists' Research Club (McAtee, 1945:16–18) afforded him the opportunity to provide witty commentary on the various species names of the genus (e.g., **Pinus attenuata** — Alas!; **Pinus contorta** — Ouch!; **Pinus edulis** — In what company?; **Pinus flexilis** — How very unfortunate; **Pinus rigida** — The pink of perfection).

The works are educational because I learned much from reading them. I learned not just factual details about odd nomenclature, but also gained insights about McAtee as a scholar and a writer, and was prompted to reflect about the times in which he compiled and wrote. His comments on wartime restrictions gave me pause to consider other aspects of the complications of living with rationing during the war, and to reflect on the challenges McAtee's generation faced in the decades before that global conflict. For example, the numerous small scraps of paper upon which he made his notations suggest a frugality and parsimony that was shared by many who lived through the Great Depression.

In the end McAtee left me with one enduring struggle. 'Nomina' I get, but what does 'Abitera' mean? I have scanned dictionaries, requested and received help from Latin, Greek, and Italian scholars, sought the guidance of bibliographers and librarians… and have come up short. My friend Marilu Tavagna, a native speaker of Italian and a Latin scholar, suggested without surety that it might mean '[the names] that are gone, in the sense that the names are disused and forgotten.' That certainly makes sense in context. McAtee's wartime lament about limitations of available type-font and diacritics suggests another possibility that I never explored with Marilu. With the proper diacritic, Nomina Abiterà can be read as "names that will live." Because of the diligence Waldo McAtee applied to compiling these largely overlooked or forgotten names, and the effort and money he expended in printing and circulating the compilations themselves, these interesting pieces of nomenclature may indeed live on. I didn't ask Marilu about this because I did not want to be disappointed by an answer I might receive. McAtee had a sharp mind and a subtle wit—perhaps he intended both meanings. I wish I could ask him.

Acknowledgements

Breck Bartholomew made numerous contributions to this effort, in the form of providing literature, input on literature,

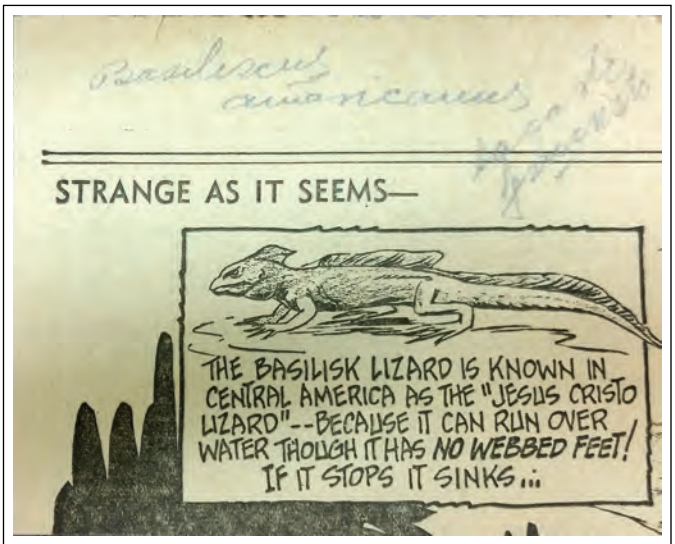

STRANGE AS IT SEEMS—
THE BASILISK LIZARD IS KNOWN IN CENTRAL AMERICA AS THE "JESUS CRISTO LIZARD"--BECAUSE IT CAN RUN OVER WATER THOUGH IT HAS NO WEBBED FEET! IF IT STOPS IT SINKS...

Fig. 16. McAtee's note on *Basiliscus americanus* in *Nomina Abitera* is attributed to "press account" and was based on this clipping. No indication of the source was recorded.

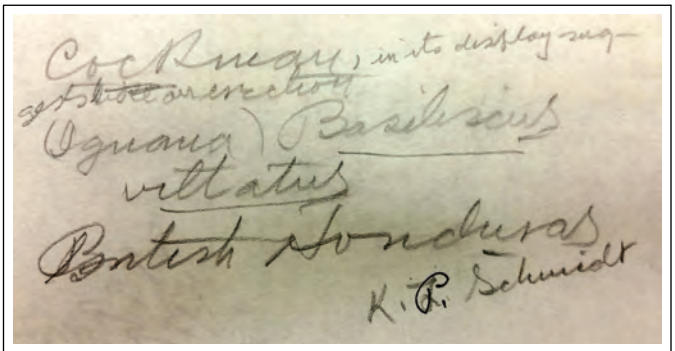


Fig. 17. McAtee's note on the common name "cockman" for *Basiliscus vittatus* in Belize (British Honduras). The contribution is attributed to Karl P. Schmidt.

general encouragement to write this, and assistance with other logistical issues. Kraig Adler provided the photo of McAtee that I used as Fig. 1. Shiela Winchester was a big help with literature, particularly with locating *Dialect Notes* and rescuing those from the category of 'missing' at The University of Texas libraries. Amy Kimball conducted a search for *Nomina Abitera* at Johns Hopkins University library, and Bond did the same in the Special Collections at the University of Michigan. I have enjoyed conversations with the late Carl Gans, the late Charles Repenning, Will Godwin, and Mitchell Riegler about McAtee and his eccentricities. Photographs for Figs. 2, 3, 6, 8, and 9 were taken by Stacie Skwarcan, and she assisted with digital processing of other images; her assistance and patience are both much appreciated. Susan Crane, Kevin Pluta, Thomas Rover, Andrew Riggsby, Maria Luisa Tavagna, Nicola Tisato, and Shiela Winchester all attempted to help me in my unsuccessful attempts to definitively resolve McAtee's use of the word *Abitera*; my failure there is a reflection my own inadequacies and in no way diminishes their efforts to help me. Comments on early drafts of this manuscript were provided by Breck Bartholomew, Vic Hutchison, Ken Dodd, Ken Marks, Mitchell Riegler, Lazaro Viñola-López, and Geraldine Swartz. I thank Mitchell Riegler and Lazaro Viñola-López for accepting the challenge, forcing my hand, inspiring the completion of this work, and resuscitating a game I had let slide for 26 years. I am grateful for their friendship and collaboration.

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International Society for the History and Bibliography of Herpetology
Bibliotheca Herpetologica

Alligators in the Circus Ring—An unusual habitat for an American Icon

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Introduction

In Europe, animal shows featuring trained exotic animals were popular up until the 2010s. Shows with young chimpanzees, bears, lions, tigers, sea lions, Asian elephants and Indian rhinos attracted many spectators. In the circus world, these attractions were known as exotic acts.

One of these exotics, the American Alligator (*Alligator mississippiensis*)—an icon of American folklore and herpetofauna—played a significant role in the European circus and vaudeville scene. Three of the more prominent performers who used alligators are discussed here.

Koringa

Among the exotic animal circus acts were the performances of the French tamer Koringa, who showcased her 'hypnotized' crocodiles (American Alligators) around 1939 and after World War II. The artist known as Koringa was born Renée Bernard (1913–1976) in Bordeaux. Around 1937, she performed in a small circus in France, thrilling the audience as a fakir with her quick barefoot dance on a ladder whose rungs were made of polished knives. She would then transform into an exotic beauty from the Orient with an impressive hairstyle, supported by similarly dressed assistants, and perform with crocodilians and giant snakes. Later that year she was discovered by circus director Cyril Mills of the Mills Brothers from England (Fig. 1).

As "the only female fakir in the world" she received a two-year engagement with Bertram Mills' Circus & Menagerie for the main performances at the world-famous Tower Circus in Blackpool, England (Fig. 2).

Subsequently, Koringa had further engagements with her American Alligators and Indian Pythons (*Python molurus*) in circuses in France and South Africa. Koringa stated in interviews that she was born in India and raised as an orphan by fakirs in Biker. "It was from them that she purportedly learned the arts of sorcery and magic, including the ability to mesmerize, walk over broken glass with her bare feet, and be buried in a snake-infested sand pit (Toulmin 2007)." One of her famous acts was a barefoot walk over five 'hypnotized' alligators, adorned with a necklace of several live giant snakes. During World War II, she became involved as an active member of the French resistance against the German occupiers. After the war, she toured with her performances, including with the Althoff Circus, at the Hansa Varieté Theater in Hamburg, among others. In 1960, she retired in France (Toulmin 2007; Fig. 3).

Fig. 1. The French animal trainer Koringa hypnotizing a American Alligator, 1939. (Source: Photo: Germin © Slub / Deutsche Fotothek).

Two videos featuring Koringa are available on the internet. One on British Pathé: https://www.britishpathe.com/asset/79036/ and the other on YouTube by Raffaele de Ritis: https://youtu.be/6tifd_FWy6M?si=K3HRxhhd_P743GnH.

Karah Khavak

Another unusual approach to performing crocodilians in the circus ring could be seen in the performances of the Czech magician Karah Khavak (Ludwig Kocka 1903–1986). These approaches, unknown to herpetologists, are unusual. In 1952, 1957, and 1969, "the world's leading crocodile hypnotist" toured Switzerland with the Swiss Circus Knie and performed

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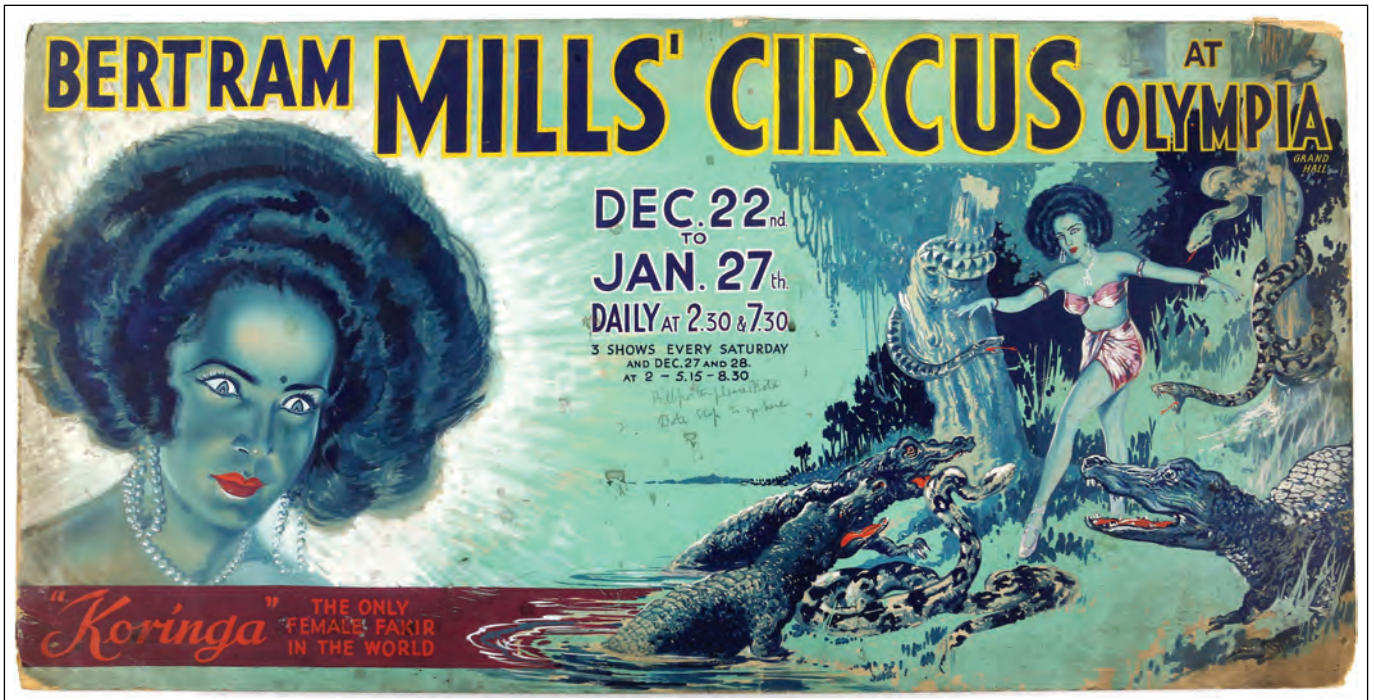
BERTRAM MILLS' CIRCUS AT OLYMPIA
GRAND HALL
DEC. 22nd
TO
JAN. 27th.
DAILY AT 2.30 & 7.30.
3 SHOWS EVERY SATURDAY
AND DEC. 27 AND 28.
AT 2 - 5.15 - 8.30
"Koringa" THE ONLY FEMALE FAKIR IN THE WORLD

Fig. 2. "Koringa" The only female fakir in the world. Poster of Circus Olympia 1902 (Source: Ewbank's Auction House, Woking, UK. 28. Februar 2000).

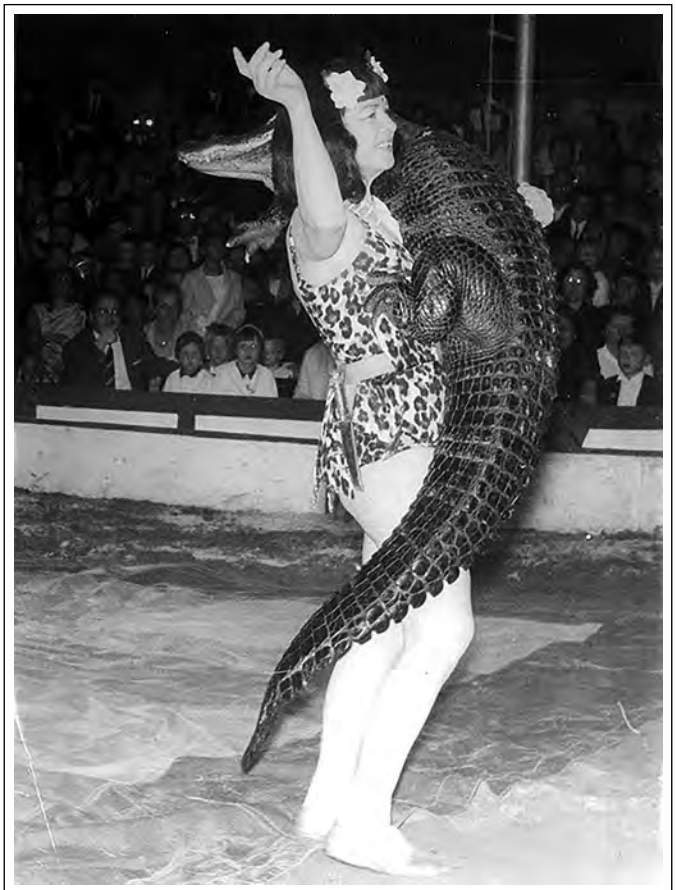

Fig. 3. Koringa with an Alligator (undated photo; photographer unknown).

with several adult American Alligators and a Nile Crocodile (*Crocodylus niloticus*). The crocodilians ran freely in the ring until they were "hypnotized" to stand still by the magician, who then picked them up. The "tail-waving" of the crocodilians when carried around by the magician after the show was not an expression of enjoyment towards the applauding crowd, but rather the reaction of the crocodile to having its cloaca penetrated with a finger which released pressure on the inner tail muscles (Heini Hofmann, personal communication, July 13, 2022). In 1952, the magician explained to journalists that he had received his stage name from an Indian maharajah. Karah Khavak and his wife Marianna—who performed with giant snakes—became a star attraction at the Moulin Rouge in Paris for over ten years. He also appeared in films for the Lacoste fashion company and on television, and performed at other international circuses, vaudevilles and galas.

In 1969, Circus Knie used Karah Khavak's act in its advertisements, writing "Dressage or hypnosis? Even visitors to Circus Knie this season won't be able to answer this question. It has a ghostly effect when the crocodiles rush towards the edge of the ring with their jaws wide open and suddenly freeze under the mysterious gestures and incantations of the magician Karah Khavak. That the master does not reveal his secret is understandable (Press text Circus Knie, 1969; Fig. 4)."

A "reptiliarium" was built especially for the Circus Knie tour consisting of a specially constructed circus wagon with a basin 2 x 3 m (ca. 6 x 9 feet) and 80 cm (2.5 feet) deep and wooden decks, featuring a heating system that worked even in cases of power outages and while traveling. The water in the basin was heated to 25°C. The reptiliarium had special

windows so the public could view these fantastic reptiles for a fee in the traveling zoo.

Pernelet

Little information is available on the French crocodile tamer Pernelet, who performed with his crocodiles between roughly 1888 and 1915 in North African and European menageries, circuses, and large theaters. For this reason, it is worthwhile to review the life and work of this dazzling personality and his extraordinary relationship with Crocodilians.

As a basis for this review, I consulted the essays, "The Taming of Crocodiles: M. Pernelet and his strange Hobby" (Charles 1902) and "A Master of Crocodiles" (Western 1909) as well as an interview with the German herpetologist Paul Krefft (1872–1945) on one of his performances with the Schumann circus in Berlin (Krefft 1905).

Auguste Pernelet was born about 1860. He traveled as an adventurer in Egypt and in the former French colonies of Africa. After 1880, he became intensely interested in crocodiles. In Senegal and Gabon, he caught Nile Crocodiles (*Crocodylus niloticus*) and kept them in his private enclosures at Charleville, in the French Ardennes. There he began to work with the crocodiles; that is, he tried to approach them without them fleeing or attacking him. Pernelet always stressed the importance of approaching a crocodile only from the front—never from the side, or they would bite. He always carried only a small stick, no bigger than a baton, when interacting with the crocodiles. It was used to direct the animals. A light touch on the head would be enough to calm a crocodile.

Pernelet claimed to have had as many as 70 animals at one time. The crocodile connoisseur said he had captured "almost all of them himself " in Senegal or Gabon. Prior to 1903, he hatched crocodilian eggs using a homemade incubator and integrated the young into his group over time. He also claimed to have caught the fourteen American Alligators, that he would later show, in the swamps of Florida and Louisiana in 1882. He would have baited them, along with local helpers, and lured them into traps. I have found no data on his entry into the U.S., or travels within the country.

Over time—the dressage work lasted more than ten years—Pernelet managed to work with the crocodiles in the water and feed them individually with small pieces of meat. He repeatedly emphasized that his relationship with crocodiles was "con amore." He was very fond of the animals claiming they responded individually when he called their names, and that they knew him personally. From Charleville, he also supplied museums with zoological specimens and other menageries with live exotic animals (Dessem 2020).

Around 1900, a French menagerie owner "discovered" Pernelet and offered him £300 to demonstrate his skills with crocodiles. For his demonstration, Pernelet climbed into a six-meter-long and three-meter-wide pool with a depth of one meter, in which the crocodilians splashed around in a lively manner. He took a seat on a stool placed in the middle of this giant aquarium and had a bowl with pieces of meat handed to him. Soon the crocodiles, the largest of which measured three meters, opened their jaws and the crocodile man fed them by hand, calling individual by name. He rejected intrusive individuals by touching them with a small stick. He explained that he had been the first to succeed in taming crocodiles so that he could show them off without a muzzle and while sitting with them (Fig. 5). During a demonstration with his Nile Crocodiles at a traveling menagerie in Bône, Algeria, in October 1888, he was severely injured on his right hand while performing. He was saved by the courageous intervention of a visitor. Some women present fainted. After this accident he was in a hospital for six months. The renowned English illustrated magazine "*The Graphic*" reported on the incident with text and pictures (Anonymous 1888; Fig. 6). This incident is the only one involving Pernelet that was reported in the press. At the Olympia Theater in Paris, he stood in the ring with 14 crocodiles that "lived with others in his private zoo in Charleville in the Ardennes" (Fig. 7). In 1902, at the Palace Theater in London he performed with 45 Crocodiles—an engagement that lasted four months.

Fig. 4. The magician Karah Khavak with an Alligator at the edge of the circus ring, 1969 (Archive Circus Knie, Rapperswil).

In May 1905, the "appearance of Captain Pernelet with his 40 crocodiles" at the Olympia Theater in Dortmund was touted as "The Greatest Wonder of the World." The theater held 1700 guests. Because of the tight schedule, Pernelet

Fig. 5. Pernelet and his "singing crocodiles" (The Windsor Magazine, London, August 1902).

Fig. 6. Monsieur Pernelet among his crocodiles: Feeding crocodiles in a Menagerie at Bône. Algeria, with the postscript "Shortly after this photograph was taken, the crocodiles attacked M. Pernolet (sic) and seriously wounded him". October 8, 1888 ("The Graphics",1888 38:17, Photo H. G. Robley; © Newspapers.com).

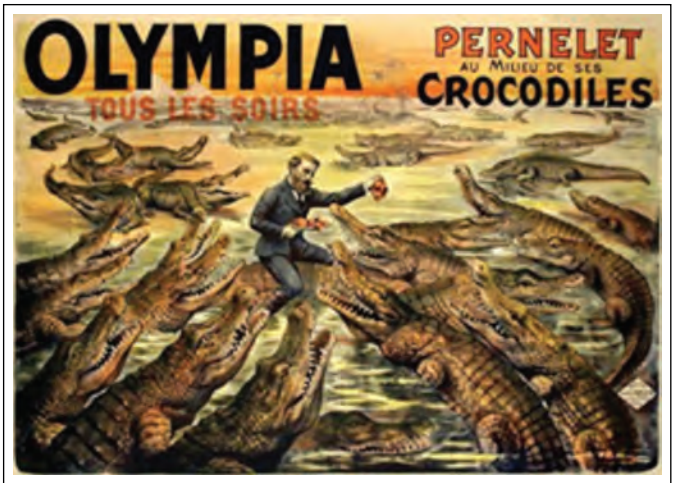

Fig. 7. Poster: "Olympia Tous les Soirs" — "Pernelet au Milieu de ses Crocodiles", Paris (41 x 60 cm) (no indication of origin).

OLYMPIA-THEATER
DORTMUND, AM BURGWALL 9
FERNRUF 1850.
Heute Montag, den 1. Mai:
Grosse Gala-Première.
Das grösste Weltwunder.
40!! Krokodile!
Kapitän Pernelet mit seinen 40 Krokodilen!
40!! Krokodile!
Es ist dieses eine der sensationellsten und aufsehenerregendsten Dressurnummern, die je am Variétés gezeigt worden ist und bildete im Londoner Palasttheater 4 Monate lang die Sensation des Tages!
Kapitän Pernelets
!!40 Krokodile 40!!
ist die einzigste und unkopierbare Schaustellung in der
ganzen Welt,
dessen Engagement
*36788
ein Vermögen
kostet und wegen der enormen Unkosten bis heute nur in den größten Weltstädten vorgeführt wurde.

Fig. 8. "The greatest wonder of the world", "Captain Pernelet with his 40 crocodiles". (Dortmund, May 1, 1905) (Klaus Winter Collection).

could not extend his two-week engagement (Winter 2020). The nickname "Kapitän" came from the time when he worked as a captain on a schooner in the Red Sea (Engström 1939; Fig. 8).

Pernelet had another performance with 25 crocodiles, with the Busch Circus, in Stockholm in 1907 (dated picture postcard from 1907; Fig. 9). The Swedish author and satirist Albert Engström (1869–1940) reports about this in a very casual form (Engström 1939).

Pernelet and his crocodiles were also an important attraction at the World Exhibition of 1910 in Brussels. It was there, on the night of August 14–15, 1910 that several of his crocodiles perished in a devastating fire (Dated picture postcard from 28 August 1910; Fig. 10).

Fig. 9. Pernelet and his crocodiles (picture postcard from Stockholm, postmark August 21, 1907).

Fig. 10. At the great fire (August 14–15, 1910) in the World's Fair of Brussels 1910, some crocodiles of Pernelet were also killed (picture postcard, postmark August 28, 1910).

His last documented performances date from 1915–1920, where he showcased his alligators in his Acquario-Indo-Africano in Florence.

Reports of these breathtaking displays of "tamed" crocodiles were printed in many newspapers, including some English newspapers overseas (Dessem 2020 and references within). Some articles published in London were illustrated with photographs (Anonymous 1888; Charles 1905). Wherever Pernelet performed with his crocodiles, picture postcards were sold using the same promotional photograph seen in figures 6 and 9. Postmarks on these postcards give a good idea of the date of his performances. The oldest and best known is the postcard showing the tamer in a pool surrounded by at least fourteen alligators (Fig. 6). This picture was taken in the summer of 1888 in Bône, Algeria: "Feeding crocodiles in a menagerie at Bône, Algeria. Shortly after this photograph was taken, the crocodiles attacked M. Pernolet (sic) and seriously wounded him". At that time, he owned no less than seventy crocodiles (Anonymous, 1888).

Better than any words, the photogravure after A. Wald, ca. 1900 "Demonstration of tamed crocodiles in the Circus Schumann Berlin", shows the individual scenes of the risky show. This illustration suggests the enormous effort required for the daily production of the show. A considerable expenditure (enclosures, basins, pumps, transport boxes, meat storage, etc.) must have been required to maintain the animals and to produce each show. As might be expected, the crocodile tamer was limited to engagements during the warmer months of the year. At the time of the performance in Berlin, only "one particularly vicious animal," possibly a Nile Crocodile, wore a solid leather muzzle. Fig. 11.

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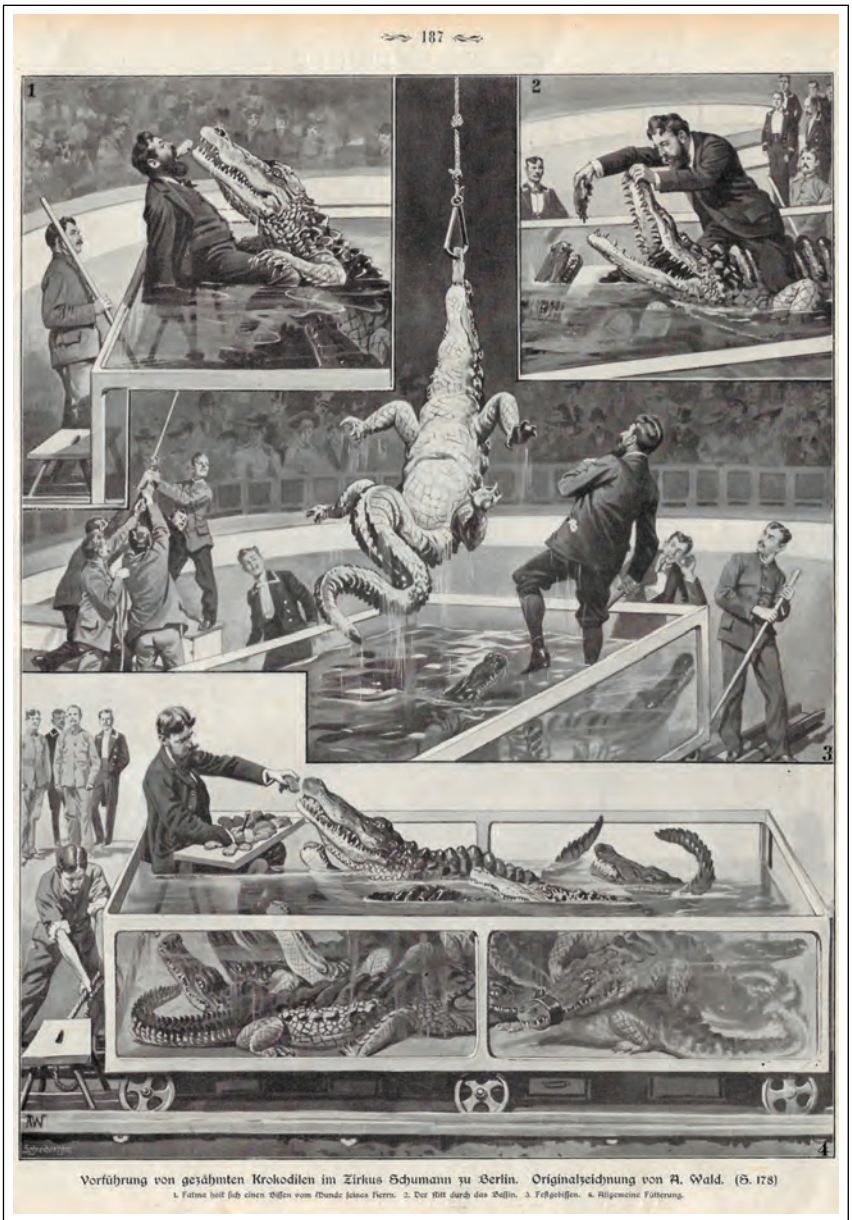
187
1
2
3
4
Vorführung von gezähmten Krokodilen im Zirkus Schumann zu Berlin. Originalzeichnung von A. Wald. (S. 178)
1. Fatme holt sich einen Affen vom Rande seines Herrn. 2. Der Alte durch das Bassin. 3. Festgebissen. 4. Allgemeine Fütterung.

Fig 11. Demonstration of tamed crocodiles in the Schumann Circus, Berlin (photogravure after A. Wald, ca. 1900 (32 x 24 cm), Anonymous (1905) (Honegger collection).

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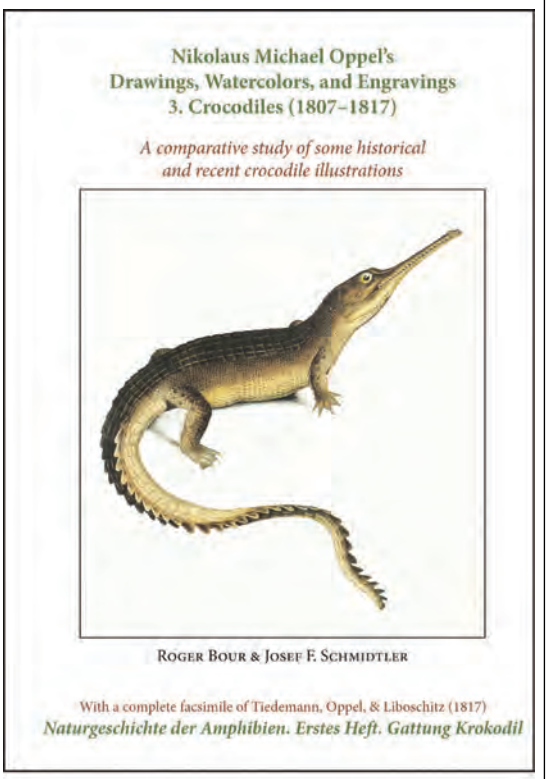
Nikolaus Michael Oppel's
Drawings, Watercolors, and Engravings
3. Crocodiles (1807–1817)
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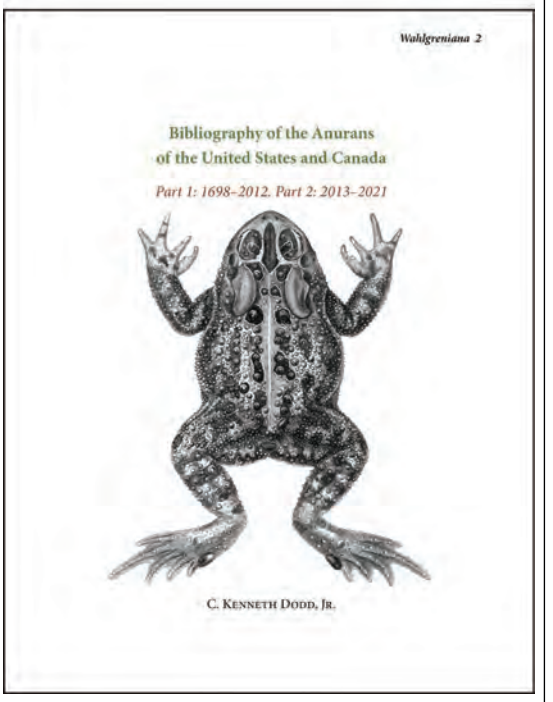
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